COASTAL ENVIRONMENTAL MONITORING

HEARING

BEFORE THE

SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH AND ENVIRONMENT

OF THE

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY U.S. HOUSE OF REPRESENTATIVES

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SECOND SESSION

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COASTAL ENVIRONMENTAL MONITORING

TUESDAY, JUNE 26, 1990

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE
RESEARCH, AND ENVIRONMENT,
Washington, D. C.

The subcommittee met, pursuant to call, at 10:15 a.m., in Room 2325, Rayburn House Office Building, Hon. Henry J. Nowak [acting chairman of the subcommittee], presiding.

Mr. NOWAK. The subcommittee will come to order.

This morning we will have a little interruption with the schedule. This hearing, I guess, was scheduled before the Mandela appearance before the House, so we will have to break. But we will proceed and at least get the testimony of the first panel, and we will have that opportunity to come back then for the other testimony immediately after the House hearing. So we will start the committee, and I have a brief opening statement on this matter.

The estuarine and near coastal regions of our country, including the Great Lakes, are among the world's most productive habitat. Each year, 70 percent of our fish and shellfish catch comes from this ecosystem. The same estuarine areas, however, are under assault. Home to over 50 percent of our Nation's population, our estuaries and near coastal areas are being stressed and degraded by the demands of a population that is expected to grow even more in the coming decade.

At the same time we are relying on these areas to provide even greater food and recreational resources for this growing population we are creating and which is discharging more and more of our wastes into these areas. Nature's delicate defenses are being overwhelmed.

The Clean Water Act has addressed point source problems, and we have seen real progress in many years. But, in spite of the $20 billion spent annually on water pollution control, many estuarine and near coastal areas appear to be continuingly declining. One reason is the imbalance in funds spent on estuarine areas in near coastal States. Coastal States, where nearly three quarters of our population is expected to reside within the next decade, receive only one-third of the Federal water pollution funds.

Another reason is the difficulty in addressing nonpoint sources of pollutants and the cumulative effects of the multiple pressures we put on the coastal landscape. We have a long way to go to understand the interactive effects of the wastes we unleash into the environment, let alone developing feasible solutions that will reduce

nonpoint source pollution and restore ecological health to these regions.

While Congress has passed legislation establishing monitoring programs in several agencies, including the Environmental Protection Agency and NOAA, a recent report by the National Academy of Sciences found that despite considerable efforts and expenditures, most environmental monitoring programs fail to provide the information needed to understand the condition of the marine environment or to assess the effects of human activity on it.

To understand the multiple environmental pressures, long-term research and monitoring efforts are necessary to provide baseline and trend information on the near coastal zone. We need research to identify the changes caused by pollution and to establish the cause and effect relationship between human activities and the degraded quality of that environment. Research also needs to help us set priorities among the various problems, so we can first address the worst problems.

As the recent National Academy of Science report shows, addressing the cumulative effects and impacts of human activities on our coastal environment will require a new monitoring strategy and new research designed, particularly if we intend to sample data on a regional and on a national scale. It is therefore with great interest that the Committee welcomes representatives from NOAA and EPA here today to discuss their efforts at creating a national coastal environmental monitoring program.

I look forward to your testimony and that of your colleagues from the Coastal States organizations and the various National Estuarine Research Reserves, and we will turn to our witness list. The first panel is consisting of EPA and NOAA, and we have from NOAA Charles Ehler, who is Coordinator, Oceanography and Marine Assessment Program. If you will come to the witness table, Charles, along with John Skinner, who is the Deputy Assistant Administrator, Office of Research and Development, Environmental Protection Agency, in Washington, D.C.

Gentlemen, I know you have submitted formal testimony.

I want to welcome Claudine Schneider, who is the minority leader of this subcommittee. And, before we turn to our witness, very quickly, I would recognize Claudine Schneider for any statement or comments she wishes to make at this time.

Ms. SCHNEIDER. Thank you very much, Mr. Chairman. I would like to ask that my full statement be included in the record, and I would just like to commend you for convening this hearing.

I think that very clearly EPA and NOAA each serve very vital roles in the protection of our coastal areas, and one of their most important missions is to maintain through research and through monitoring, an environmental "early warning system". That way, when we are doing the monitoring and we take a preventive mode, we will be able to detect various signs that an ecological system could be threatened by human activity.

And a lot of this work is carried out by EPA's Environmental Monitoring and Assessment Program (EMAP) and also NOAA's Environmental Status and Trends Program. I want to point out, however, there was a recent report by the National Research Council that concluded that both of these programs should be strength-

ened and strongly supported. And, at the same time, it warned that these programs have to be carefully coordinated to avoid duplication, so that we can be assured that we are getting the absolute most from our limited Federal dollars. And clearly, this Committee offers us the opportunity to make sure that we are using taxpayers' dollars wisely and we are not generating duplication.

Because of the importance of the estuaries to coastal environments, I am delighted that we will be hearing from Allan Beck, who is a very able manager of our Narragansett Bay National Estuarine Research Reserve in Rhode Island.

And it is an area covering—the Reserve is an area covering about a thousand acres of land on Hope Island, Patience Island, and part of Prudence Island, and about 1,600 acres of water in the Narragansett Bay. The purpose of this particular Reserve is twofold, as I am sure he will elaborate on. It offers exciting research possibilities for marine scientists to improve our understanding of these systems, and it also preserves from disturbance a substantial estuarine system critical to the health of the bay.

I believe that the Narragansett Research Reserve offers a good model for how we can succeed in protecting the environment through State, Federal, and private cooperation and commitment. So I look forward to Mr. Beck's testimony and his success story. And I also look forward to our expert witnesses, whom we have heard from over the years. And so, Mr. Ehler, it is a pleasure to welcome you. And, John Skinner, we look forward to your comments also.

Thank you very much, Mr. Chairman.

[The prepared statement of Ms. Schneider follows:]

STATEMENT OF THE HONORABLE CLAUDINE SCHNEIDER
HEARING ON COASTAL ENVIRONMENTAL MONITORING
NRARE SUBCOMMITTEE
JUNE 26, 1990

EPA and NOAA each serve vital roles in the protection of our coastal areas. One of their most important missions is to maintain through research and monitoring an environmental "early warning system" that can detect signs that an ecological system could be threatened by human activities.

Much of this work is carried out by EPA's Environmental Monitoring and Assessing Program (E-MAP) and NOAA's Environmental Status and Trends Program. A recent report by the National Research Council concluded that both of these programs should be strengthened and strongly supported. At the same time, it warned that these programs must be carefully coordinated to avoid duplication so that we can be assured that we are getting the most from our limited federal dollars.

Because of the importance of estuaries to coastal environments, I am delighted that today we will be hearing from Allan Beck, the very able manager of the Narragansett Bay National Estuarine Research Reserve.

The Reserve is an area covering over 1,000 acres of land on Hope Island, Patience Island, and part of Prudence Island and about 1,600 acres of water in the Narragansett Bay. The purpose of the Reserve is two-fold: (1) it offers exciting research possibilities for marine scientists to improve our understanding of these systems; and (2) it preserves from disturbance a substantial estuarine system critical to the health of the bay.

I believe that the Narragansett Research Reserve offers a good model for how we can succeed in protecting the environment through state, federal, and private cooperation and commitment. I look forward to Mr. Beck's testimony on this success story and his recommendations for how it could be further improved.

Mr. NOWAK. Thank you very much.
Mr. Ehler, if you would like to present your testimony.

STATEMENTS OF CHARLES N. EHLER, DIRECTOR, OFFICE OF OCEANOGRAPHY AND MARINE ASSESSMENT, NATIONAL OCEAN SERVICE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION; JOHN H. SKINNER, PH.D., DEPUTY ASSISTANT ADMINISTRATOR FOR RESEARCH AND DEVELOPMENT, ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D.C.

Mr. EHLER. Thank you, Mr. Chairman, and members of the subcommittee. I'm Charles Ehler, Director of NOAA's Office of Oceanography and Marine Assessment within the National Ocean Service. My office manages the National Status and Trends Program and most of NOAA's other activities related to marine pollution assessment and monitoring. Representatives from our Office of Ocean and Coastal Resource Management are also here accompanying me to be able to respond to any specific questions you might have on the Estuarine Reserve Program.

I am pleased to be here this morning to discuss NOAA's coastal monitoring activities including our Status and Trends Program, the developing relationship between our program and EPA's new EMAP (or Environmental Monitoring and Assessment Program), monitoring activities in NOAA's National Estuarine Research Reserve System, and the promise of satellite remote sensing for coastal monitoring, and, obviously, address any other questions you might have.

I am sure we agree that this is an ambitious agenda, and I will quickly cover key points from my prepared testimony and then try to respond to your specific questions.

Since 1984, NOAA's National Status and Trends Program has collected and analyzed the concentrations of about 50 different contaminants in surface sediments and bottom-feeding fish and mussels and oysters from about 300 coastal sites around the United States. Results of this program have been used by NOAA and by others to determine the current status of chemical contamination in our Nation's estuarine and coastal areas, to detect temporal trends at these locations, and to document responses or bio-effects to that contamination by marine organisms.

Fish and bivalve samples are collected every year at most sites. Collection of sediments is now conducted once every 3 to 5 years. We have used the existing National Status and Trends sediment data, for example, to provide an important national overview on the status of coastal contamination over the past six years. To our knowledge, this program is the only available comprehensive national survey of contaminant levels in marine and estuarine sediments and animals. Over 75 published reports and papers presenting the results of this program are available from NOAA.

Our results show that contamination, indicated by the presence of chemical substances introduced by human activities, is literally everywhere. However, the concentrations of many of the contaminants at the stations sampled are usually at intermediate to low levels. The high levels are usually near urban areas such as Boston, New York, San Diego, Los Angeles, and Seattle. These high

levels of contaminants are often found in association with a relatively high occurrence of fin erosion and, in the worst cases, tumors in internal organs of fish.

Our sampling sites were chosen to be representative of large estuarine and coastal areas, and specifically to avoid localized contaminant hot spots such as those that occur in the inner areas of many industrialized harbors and at the ends of wastewater outfalls. While the highest contaminant levels in the Status and Trends database are from estuaries and embayments near urban areas, we know that even higher values have been found in hot spots through local monitoring programs, and I think that points out the continuing need for State and local monitoring efforts to simply expand on our abilities to characterize these problems at the national level.

For example, sediments from within the Marine Terminal in Los Angeles, the industrialized waterways of Seattle and Tacoma, and near the piers in Boston and Baltimore, have higher levels of contamination than are found by us at the National Status and Trends sites near these cities.

For the past year, NOAA's National Status and Trends Program has been closely coordinated with EPA's new Environmental Monitoring and Assessment Program, or EMAP, managed by the Office of Research and Development.

A joint EPA/NOAA activity for coordination of these programs was established in 1989 and is developing the foundation for a unified national program for monitoring the status and trends of environmental quality of the waters around the coasts of the United States. Regular coordination meetings have been held at approximately monthly intervals for the past year and a half. A memorandum of understanding between our two agencies for joint program activities will be signed soon.

Joint planning currently includes quality assurance protocols, plans for a joint NOAA/EPA program office, joint technical workshops, coordinated vessel requirements, potential integration of information management systems, and joint program peer reviews.

For example, a coordinated QA/QC (Quality Assurance/Quality Control) Program has been established. Four EPA laboratories are participating in our laboratory analysis intercomparison exercises. NOAA reference materials commissioned from the National Institute of Science and Technology and the National Research Council of Canada have also been made available by NOAA to the EPA laboratories participating in the EMAP Program.

A plan has been developed to coordinate joint activities to characterize the Virginian Province. That is the area that EPA is first going to sample. It includes NOAA studies of bottom sediment types and point and nonpoint pollution sources, and is funded in 1990 with partial support from EPA. NOAA scientists and technicians participated actively in the first EMAP field activities just this past month.

Both NOAA and EPA have conducted external peer reviews of their programs in 1990. Although reviews were conducted separately this year, we have agreed that they will be held jointly in 1991. Our ultimate objective is to have NOAA's National Status and Trends Program and EPA's new Environmental Monitoring and

Assessment Program work so closely together that they constitute a single, well-coordinated national coastal monitoring program.

I will now turn to a brief description of some of the monitoring activities in our National Estuarine Research Reserve Program.

Section 315 of the Coastal Zone Management Act of 1972 established a program, formally known as the National Estuarine Sanctuary Program and now known as the National Estuarine Research Reserve System, to assist States in acquiring and management of estuarine areas as natural field laboratories. The Reserve System is administered by NOAA's Office of Ocean and Coastal Resource Management, or OCRM.

Under section 315, States and Territories receive financial assistance in the form of 50/50 matching grants to acquire, develop and manage high quality estuarine areas as National Estuarine Research Reserves. These areas are used primarily for long-term scientific and educational programs that provide information essential for coastal management.

Since 1974, the system has grown from one slightly over 4,000 acre site in Oregon to an 18-site system managing nearly 300,000 acres in 16 States. The system is expected to grow in the coming years, with six additional Reserves being developed. NOAA is also considering the expansion of four existing Reserves. When the system is complete it should represent all 11 of the Nation's biogeographical coastal regions.

The scientific program consists of two major elements: directed research and long-term monitoring. The program initially focused on management-related research to enhance understanding of estuarine environments, provide information to enhance coastal and estuarine decision-making, and improve public awareness of estuaries and estuarine management issues.

In 1989, NOAA expanded the research program to include a phased-monitoring element. The phased-monitoring program addresses the need to understand long-term trends in estuarine processes, and to provide additional baseline data for the various sites. Now in only its second year, the goal of this research and monitoring program is to assist Reserves in establishing on-site monitoring that includes at least some elements comparable throughout the national system and to focus on research questions that will help understand the causes of any trends detected.

There are three key elements of the phased-monitoring program: basic environmental characterizations, preparation of site profiles, and implementation of a monitoring program that will provide the long-term information on key resources, regularly analyze and publish the findings, and provide a mechanism to evaluate the effectiveness of the program in addressing the long-term needs of estuarine resource management.

Most Estuarine Reserve monitoring efforts are in one of the first two phases of this effort. None has reached the phase of long-term data collection.

Some of the sites that are occupied by NOAA's National Status and Trends Program, which I described earlier, where mussels and oysters and sediments are collected, are in existing or proposed Estuarine Reserves. Within the 18 existing Estuarine Reserves, we have nine National Status and Trends Program sampling sites.

Within the six proposed Reserves, we have five National Status and Trends sampling sites. Results from the analyses of samples from those sites allow the environmental quality within those areas to be seen in the context of the rest of the coastal waters of the Nation.

And with that I will end my oral presentation and would be happy to answer any questions that members of the subcommittee might have. Thank you very much.

[The prepared statement of Mr. Ehler follows:]

STATEMENT OF
CHARLES N. EHLER
DIRECTOR, OFFICE OF OCEANOGRAPHY AND MARINE ASSESSMENT
NATIONAL OCEAN SERVICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

BEFORE THE

SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH AND ENVIRONMENT
COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

June 26, 1990

Mr. Chairman and Members of the Subcommittee:

I am Charles N. Ehler, Director of the Office of Oceanography and Marine Assessment of the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce. I am pleased to be here this morning to discuss NOAA coastal monitoring programs. My discussion will include (1) coastal monitoring as it relates to the evolving relationship between NOAA's National Status and Trends (NS&T) Program and EPA's new Environmental Monitoring and Assessment Program (EMAP); (2) coastal monitoring within the National Estuarine Reserve Research System (NERRS); and (3) the Administration's position on **H.R. 4030**, the Coastal Zone Management Act (CZMA) Reauthorization Amendments of 1990 and **H.R. 4115**, the NOAA Ocean and Coastal Program Authorization Act of 1990.

NOAA's National Status and Trends Program

Since 1984, NOAA's National Status and Trends (NS&T) Program has collected and analyzed the ambient concentrations of about 50 different contaminants in surface sediments and in bottom-feeding fish and bivalves (mussels and oysters) from about 300 coastal sites around the United States. Results from this Program are used (1) to determine the

current status of chemical contamination levels in our Nation's estuarine and coastal waters, (2) to detect temporal trends, and (3) to document responses to that contamination by marine organisms.

Fish and bivalve samples are collected every year at most sites. The same sampling frequency was used for sediments for the first three years of the program. However, collection of sediments is now conducted once every three to five years. Based on early program results, we have determined that sediments in areas sampled accumulate so slowly that annual changes in surface sediment contaminant concentrations are likely to be very small.

NOAA has used the existing NS&T sediment data to compare relative contaminant concentrations across the approximately 300 sites in the coastal United States and to provide an important national overview of the status of coastal contamination. To our knowledge, this program is the only available national survey of contaminant levels in marine and estuarine sediments. In fact, a recent report on contaminated marine sediments, written by the Marine Board of the National Research Council, concluded that ". . .the NOAA NS&T Program currently provides the most comprehensive and systematic data set on sediments." Over 75 published reports and papers presenting the results of this program are available from NOAA.

Our results show that contamination is everywhere (as indicated by the presence of chemical substances introduced by human activities). However, the concentrations of many of the contaminants at the stations sampled are usually at low levels. The concentrations for the various contaminants documented by the NS&T Program show that, for most of the substances, urbanized or industrialized sites generally have distinctly high levels and most other sites show more or less

similar concentrations at intermediate to low levels. The high levels are usually near urban areas such as Boston, New York, San Diego, Los Angeles, and Seattle. These high levels of contaminants are often found in association with relatively high occurrences of fin erosion, and in the worst cases, tumors in internal organs of fish.

The NOAA sampling sites were chosen to be "representative" of large estuarine and coastal areas and specifically to avoid localized contaminant "hot spots"; such as those that occur in the inner areas of many industrialized harbors and at the ends of wastewater outfall pipes. While the highest contaminant levels in the NS&T database are from estuaries and embayments near urban areas, we know through local monitoring programs that even higher values have been found in hot spots. For example, sediments from within the marine terminal in Los Angeles, the industrialized waterways of Seattle and Tacoma, and near the piers in Boston and Baltimore, have higher levels of contamination than are found by NOAA at the NS&T sites near these cities. Based on our results, we know that the worst hot spots are less extensive than entire estuaries and are unrepresentative of the sediment contamination levels throughout these estuarine systems. The NS&T results cannot be used to delineate the extent of highly contaminated sediments that occur primarily within parts of our highly industrialized harbors. However, the results can establish that the great majority of areas around our coasts do not show evidence of substantial levels of contamination in sediments.

Coordination of Coastal Monitoring Programs Between NOAA and EPA

For the past year, NOAA's NS&T Program under the Office of Oceanography and Marine Assessment, has been closely coordinated with EPA's Environmental Monitoring and

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Assessment Program (EMAP) under the Office of Research and Development.

A joint EPA/NOAA activity for coordination of the coastal and estuarine environmental monitoring programs (EMAP and NS&T) was established in 1989 and is developing the foundation for a unified, national program for monitoring the status and trends in the environmental quality of the waters around the coasts of the United States. Regular coordination meetings are held to (1) exchange information, (2) recommend new plans, and (3) agree upon joint actions. Meeting minutes are distributed to interested parties within EPA and NOAA. A NOAA/EPA Memorandum of Understanding for joint program activities has been drafted.

Joint planning activities currently include (1) quality assurance protocols, (2) a joint NOAA/EPA program office, (3) joint technical workshops, (4) vessel requirements, (5) desktop information management systems, and (6) joint program peer reviews.

For example, a coordinated Quality Assurance/Quality Control Program has been established. Four EPA laboratories are participating in NS&T laboratory analysis intercomparison exercises. NS&T reference materials, commissioned from the National Institute of Science and Technology (NIS&T) and the National Research Council of Canada, have been made available to the EPA/EMAP laboratories.

A plan has been developed to coordinate NOAA/EPA activities to characterize the Virginian Province (Cape Cod to Cape Hatteras). It includes NOAA studies of bottom sediment type and point and nonpoint pollution sources, and will be funded in FY 1990 with partial support from EPA/EMAP. Also under consideration is EMAP partial funding in FY 1990 of NOAA characterization studies of estuarine salinity and freshwater inflow, coastal wetlands, eutrophication, living

marine resource distributions, and classification of shellfish growing waters.

Both NS&T and EMAP have conducted external peer reviews of their programs in 1990. Although reviews were conducted separately this year, NS&T and EMAP have agreed that they will be held jointly in 1991. The ultimate objective is to have NOAA's NS&T Program for Marine Environmental Quality and the Near Coastal Ecosystems component of EPA's developing Environmental Monitoring and Assessment Program work so closely together that they constitute a single, well-coordinated national/regional coastal and estuarine monitoring program.

Monitoring Activities Within National Estuarine Reserves

Section 315 of the Coastal Zone Management Act of 1972 established a program, formerly known as the National Estuarine Sanctuary Program and now known as the National Estuarine Reserve Research System (NERRS), to assist states in acquiring and managing estuarine areas as natural field laboratories. The NERRS is administered by the Marine and Estuarine Management Division of NOAA's Office of Ocean and Coastal Resource Management (OCRM). Under section 315, states and territories receive financial assistance in the form of 50/50 matching grants to acquire, develop and manage high quality estuarine areas as national estuarine research reserves. These areas are used primarily for long-term scientific and educational programs that provide information essential to coastal management decision making.

Since 1974, the NERRS has grown from one 4,400 acre site in Oregon to an 18-site system managing nearly 300,000 acres in 16 states. Each site offers opportunities for detecting changes within the estuarine system, while protecting the

integrity of the site for long-term research. By comparing these protected, biogeographically representative areas with other estuarine areas subject to various human activities, it is possible to determine the effects of these activities on estuarine resources. This enables decision makers to devise sound coastal management policies for allowing development while minimizing adverse impacts. The reserves also provide opportunities for the general public to learn to appreciate coastal and estuarine ecology in an outdoor setting.

The newest reserves are Waquoit Bay, Massachusetts, which was designated in 1988, and Great Bay, New Hampshire, which was designated in 1989. The NERRS is expected to grow in the coming years, with six additional reserves being developed in Delaware, Virginia, South Carolina (two), New York and California. OCRM is also considering the expansion of four existing reserves in North Carolina, Maryland, Florida, and New York. When the network is complete, it should represent all 11 of the Nation's biological and geographical coastal regions, selected by OCRM to reflect regional variations in the coastal zone. The biogeographical classification scheme, which is used to ensure that the system includes at least one site from each region, has 27 subregions. Eleven of those biogeographic subregions are not yet represented in the system.

The estuarine reserves provide field laboratories for studying the natural and human processes that affect estuaries so that stresses on these highly biologically productive areas can be minimized. In 1985, OCRM developed a comprehensive and coordinated program of estuarine research. The applied research program provides a data and information base pertinent to local, regional and national estuarine management issues. It also provides the opportunity for improved information exchange among government, industry,

academia, and the general public on matters concerning multiple, and often conflicting, uses of estuaries and their resources.

The NERRS research program consists of two major elements: (1) predictive research; and (2) long-term research (i.e., monitoring). The program focuses on management-related research to enhance our understanding of estuarine environments, provide information necessary to enhance coastal and estuarine resource management decision making, and improve public awareness of estuaries and estuarine management issues. In 1989, OCRM expanded the NERRS research program to include a phased monitoring element. The phased monitoring program addresses the need to understand long-term trends in estuarine processes and to provide additional baseline data for the various sites. Now in its second year, the goal of this competitive program is to assist reserves in establishing on-site resource monitoring programs that include at least some elements comparable throughout the national system and to focus on predictive research questions that will help understand the causes of trends detected.

There are three key elements of the phased monitoring program: (1) basic environmental characterizations to build an accurate baseline of information on the sites' most important resources; (2) preparation of site profiles that describe the resources, management issues, and long-term plans for monitoring; and (3) implementation of a monitoring program that will provide long-term information on key resources, regularly analyze and publish the findings, and provide a mechanism to evaluate the effectiveness of the program in addressing the long-term needs of estuarine resource management.

The first phase -- environmental characterizations --

helps reserve managers gain a better understanding of the resources they are expected to manage. This includes developing descriptions of the hydrology, geology, water chemistry/quality, biological resources, and the problems and issues confronting reserve management. Depending on the site, this approach may require literature research, field research, or a combination of the two. For example, the Old Woman Creek National Estuarine Research Reserve in Ohio has identified a gap in its baseline data base on invertebrates that must be addressed before planning and implementing a long-term NERRS monitoring project. In response to this need for information, OCRM funded a field research project through Kent State University in fiscal year 1989 to address this problem.

Once the first phase has been completed, the reserves can proceed with preparing a site profile -- Phase II. The site profile is a synthesis of information gathered during the first phase that provides an overall picture of the reserve in terms of its resources, issues, management constraints, and research needs. These profiles also contain high quality maps of the reserve, color and/or black and white photographs, line drawings, tables and graphs in a format similar to the Estuarine Profiles published by the U.S. Fish and Wildlife Service (FWS). The Tijuana River National Estuarine Research Reserve in California has over 10 years of baseline data and will be preparing a site profile for the reserve during fiscal year 1990.

The initiation of the long-term data collection program -- Phase III -- begins only after a reserve has completed the first two phases. Although no reserve is in Phase III at this time, a well-designed monitoring program should provide long-term data sets to document the history of change within important resources and, in combination with

the predictive research element, evaluate the significance of natural and human-induced perturbations on the ecosystem, and formulate effective resource management policies.

Among the sites occupied by NOAA's NS&T Program, which I mentioned earlier, are sites in Estuarine Reserves where mussels or oysters and sediments have been collected. Results from analyses of those samples allow the environmental quality within these areas to be seen in context with the rest of the coastal waters of the nation. By maintaining a monitoring program at these places over time, temporal changes can be detected.

During fiscal year 1989, OCRM funded six monitoring projects in five reserves. Most of these projects were for Phase I environmental characterizations. In addition, OCRM is working with other Federal agencies and various state and local resource management agencies to address regional concerns pertaining to water quality and habitat issues.

In the Waquoit Bay National Estuarine Research Reserve, for example, OCRM has been working with the National Science Foundation, the U.S. Environmental Protection Agency, the Massachusetts Coastal Zone Management Program and the Cape Cod Planning and Economic Development Commission, to address regional water quality and habitat management issues. These agencies are committed to funding this project over the next four years.

The 1986 Amendments to section 315 of the CZMA require NOAA to promote and coordinate the use of the NERRS for research purposes and to give priority consideration to research that uses the NERRS. In addition, the 1986 Amendments require NOAA to consult with other Federal and state agencies to promote use of one or more research reserves within the NERRS when such agencies conduct

estuarine research.

To further these objectives, NOAA will continue to seek opportunities to work cooperatively with other agencies to avoid duplication, share information, and assist them in furthering the objectives of their resource management programs.

The Administration's Position on H.R. 4030

I will now turn to the Administration's position on H.R. 4030, the Coastal Zone Management Act Reauthorization Amendments of 1990, and H.R. 4115, the NOAA Ocean and Coastal Program Authorization Act of 1990. In March of this year, the Under Secretary for Oceans and Atmosphere, Dr. John Knauss, testified before the House Merchant Marine and Fisheries Committee on Coastal Zone Management Act reauthorization. At that time, he expressed the Administration's commitment to revitalizing and strengthening the CZMA. For the first time in a decade, the President's Fiscal Year 1991 Budget Request provides funding for the CZMA to assist coastal states and territories to implement their Federally-approved CZM programs. The Administration CZMA reauthorization bill also was transmitted to the Congress and introduced in the House as H.R. 4438.

Both H.R. 4438 and H.R. 4030 recognize the need for a strong coastal management program. Increasing population growth along our coasts and the impact that growth has on water quality and vulnerable habitat areas has dictated the need for an expanded focus for the CZMA. We must strengthen the Federal-state partnership to develop and implement solutions to these problems.

We support many of the goals set forth in H.R. 4030, especially those that deal with wetlands protection, water

quality improvement, coastal hazards management, and increased public access. For instance, we support the concept of focusing state coastal management efforts on non-point source pollution. The experience of state CZM programs in land and water use management and their comprehensive focus on development impacts can complement the efforts by EPA and state water quality agencies to focus on water quality protection and improvement through water quality standard development.

We also agree with the need to encourage states to improve their CZM programs in specified areas as proposed in the new section 310 of H.R. 4030. The Administration takes a slightly different approach, by setting minimum requirements for incorporation of National Priority Program Elements (NPPEs) into states' approved programs. The NPPEs include enhanced wetlands protection and restoration; development and use of state programs to reduce adverse effects on the coastal zone from non-point source pollution; more aggressive response to and prevention of threats to life and property from coastal natural hazards; enhanced public access to the coast; and the development and use of state programs to reduce beach and marine debris.

We support the proposed change under section 312 of H.R. 4030, the evaluation process to allow a probationary period to correct state deficiencies in program operations. We believe such a flexible approach is the most effective way to help states to address problems in specific areas of their programs while maintaining the overall program.

We endorse the concept of recognizing individuals and governments who make significant contributions to coastal zone management through CZM excellence awards as set forth in section 314 of the CZMA as proposed in H.R. 4030.

We are, however, concerned about some proposed changes. The Administration strongly opposes any changes to the Federal consistency provisions under section 307 of the CZMA. We believe that the consistency provisions as currently structured work well and that changes are unnecessary. This same conclusion was reached in 1985, when NOAA released the findings of a Draft Federal Consistency Study. The 1985 study was conducted, in part, as a result of the 1984 U.S. Supreme Court decision in which the Court stated that the sale of Outer Continental Shelf oil and gas leases was not an activity "directly affecting" the coastal zone within the meaning of section 307(c)(1) of the CZMA and therefore a determination of consistency with approved-State CZM programs is not required before such sales are held (Secretary of the Interior et al. v. California et al. (464 U.S. 312, 1984)).

After extensive public review of the Interior v. California decision, NOAA issued a final rule modifying its regulations to conform to that decision, stating that OCS oil and gas lease sales are not subject to the consistency requirements. NOAA will continue to work with other Federal agencies on a routine basis to assure their compliance with the Federal consistency provisions by providing general policy guidance and case-specific technical assistance.

The Administration supports the proposed changes to section 315 of H.R. 4030 We believe the bill provides needed clarification for a variety of issues concerning the operation of the National Estuarine Reserve Research System. We also support the proposed change of eligibility for grants to allow private institutions and citizens to compete for research and educational grants along with State institutions.

The Administration opposes the funding levels contained in H.R 4030, which increases section 306 authorization from

the current $40.6 million to almost $61 million over the five-year period. This is inconsistent with the President's Budget request of $30 million.

The Administration's Position Concerning H.R. 4115

H.R. 4115 would authorize appropriations for certain programs of the National Ocean Service (NOS), the Office of Oceanic and Atmospheric Research (OAR), and Program Support activities of NOAA. The Department of Commerce opposes H.R. 4115 unless it is amended consistent with the President's Fiscal Year 1991 Budget.

Thank you. I will now answer any questions that you may have.

Mr. NOWAK. Thank you very much.

Before we get into the answer, we would like to have Mr. Skinner's testimony and then we will do the questioning as a panel.

Mr. SKINNER. Thank you, Mr. Chairman, members of the committee. It's a pleasure to be here today to talk to you about EPA's efforts in coastal monitoring and interagency coordination with NOAA and other Federal agencies. I'm going to just make a very brief opening statement and submit my full written statement for the record.

Main areas of coordination in the area of coastal monitoring occur both in the National Estuary Program and in our Environmental Monitoring and Assessment Program, the EMAP Program, and I have representatives from our Narragansett Research Lab here today, and also from the Office of Water, if you would like to get into some specifics on each of those programs.

Let me just say a few things about the EMAP Program, the Environmental Monitoring and Assessment Program. This program encompasses all major ecosystems. Not only coastal waters, but also forests, wetlands, inland waters, agricultural ecosystems, and will attempt to look at interactions between these ecosystems. Obviously, a program with such broad scope requires wide-scale coordination between Federal, State and local agencies. Not only with NOAA, but with other Federal agencies such as the Forest Service, the Department of Agriculture, U.S. Geological Survey, and others. And we have attempted to put in place mechanisms for assuring that coordination.

The goal of EMAP is to be able to track the status and trends of our major ecological systems, see how those ecological systems are changing, determining what's causing those changes, and to determine whether control measures that are currently in place are effective or whether additional control schemes would be needed. It is a statistically based monitoring program of national scope which will coordinate with regional monitoring programs and make use of data that is collected at the regional and local level.

It will employ various sample collection techniques, including remote sensing from both aircraft and satellites. And, in conjunction with the monitoring program, there will be a research program which will attempt to develop better measures of the indication of the health of our ecosystems. This year, in 1990, we are doing a demonstration in conjunction with NOAA on near coastal waters. We have close cooperation with them. Mr. Ehler talked about the Joint Committee for Coastal estuarine Environmental Quality Monitoring that has been formed, which meets and carries out joint planning, joint development of quality assurance/quality control, and attempts to integrate the NOAA National Status and Trends and the Research Reserves Program into the EMAP Program, and we have a memorandum of agreements which is near to be signed between the two agencies.

There's also an existing memorandum of agreement between the National Estuary Program and the Coastal Zone Management Program in NOAA. That has been in existence for several years.

We feel that this program is fully consistent with the recent Marine Board of the National Research Council's report, Managing Troubled Waters, and we agree with the recommendations of that

report that the program needs to be national in scope but needs to make good use of the existing data that is being collected at the local and regional level.

With respect to EPA's comments on recent proposed legislation, I would refer you to a statement that was made by our Assistant Administrator for Water, Ms. Lajuana Wilcher, in front of the Merchant Marine and Fisheries Committee, in March, where EPA's comments on House Bill 4030 are presented.

That summarizes my statement. I'd be glad to answer any questions you might have.

[The prepared statements of Mr. Skinner, and Lajuana Wilcher follow:]

STATEMENT OF
DR. JOHN H. SKINNER
DEPUTY ASSISTANT ADMINISTRATOR
FOR RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
BEFORE THE
SUBCOMMITTEE ON NATURAL RESOURCES,
AGRICULTURE RESEARCH AND ENVIRONMENT
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

JUNE 26, 1990

Good morning, Mr. Chairman and members of the Subcommittee. I am John H. Skinner, Deputy Assistant Administrator for Research and Development, U.S. Environmental Protection Agency (EPA). I appreciate the opportunity to discuss EPA's role in coastal monitoring.

EPA considers it critical to establish monitoring and assessment programs to confirm the effectiveness of pollution control programs and to corroborate the science upon which they are based. Monitoring, therefore, is an important element of our Agency's activities. As the environmental concerns grow in both scale and complexity, the Office of Research and Development (ORD) has a continuing need to use monitoring in support of our overall research program. One such program that was initiated in 1990 is the Environmental Monitoring and Assessment Program (EMAP).

EMAP as developed in response to the demand for information on the condition of our nation's ecological resources. Although EMAP is funded by ORD, it is designed to be an integrated Federal program. During the planning of EMAP, ORD has worked with other

Federal agencies, including the National Oceanic and Atmospheric Administration (NOAA), the U.S. Fish and Wildlife Service, the USDA's Forest Service and Agricultural Research Service, and the U.S. Geological Survey, as well as other offices within EPA. Our first field activities are underway this summer in both forests and estuaries, and are being conducted with cooperation from both the Forest Service and NOAA. Further, we have initiated efforts to begin using satellite imagery for both land-use characterization and as a monitoring tool within EMAP. The remote sensing division in our Las Vegas Laboratory, in conjunction with NASA, is planning a longer-term effort in this area, and we are optimistic about this promising approach. As we expand our efforts in 1991, we will be developing similar working relationships with the other agencies mentioned.

The goal of EMAP is to assess and document the condition of the nation's forests, wetlands, estuaries, coastal waters, inland surface waters, Great Lakes, agricultural lands, and arid lands on an integrated and continuing basis. It is designed to answer the following questions on regional and national scales over a time period of decades:

- What is the status, extent, and geographical distribution of our important ecological resources?
- What proportions of these resources are declining or improving, where, and at what rate?

- 0 What are the likely factors that are contributing to changing conditions?
- 0 Are control and mitigation programs achieving overall improvement in ecological conditions?

Assessment of status and trends of the nation's ecological resources requires that data be collected in a standardized manner, over large geographic scales, and for long periods of time. Such assessments cannot be accomplished by aggregating data from the many individual, short-term monitoring programs that have been conducted in the past or are being conducted currently. Differences in the parameters measured, the collection methods used, timing of sample collection, and existing program objectives severely limit the value of historical and existing monitoring data for conducting regional and national assessments. An integrated Federal multi-ecosystem monitoring and assessment program offers the advantages of earlier detection of problems and improved definition of their extent, magnitude, and likely causes. Such a program also enables more cost-effective regulatory and remedial actions to ensure protection and restoration of the country's ecological resources.

Information obtained from the 1990 EMAP Near Coastal Demonstration Project will be used to:

- 0 Demonstrate the value of integrated, multi-agency monitoring programs for planning, priority setting, and determining the effectiveness of pollution control actions;

- 0 Determine the effectiveness of the network design for quantifying the extent and magnitude of pollution problems and addressing objectives of multiple offices within EPA and NOAA;
- 0 Develop standardized methods for sampling near coastal environments that can be transferred to other programs and agencies; and
- 0 Identify and resolve logistical issues associated with implementing a multi-agency national status and trends ecological monitoring program.

Both NOAA and EPA have authority to conduct a broad range of research and monitoring activities to assess the effects of pollution on coastal and estuarine environments. There are, by design, similarities and differences between existing NOAA and EPA research and monitoring programs. The combined results of both agencies' programs, however, currently serve the national interest more than the results of individual programs. It is the intention of both NOAA and EPA to cooperate and coordinate fully to integrate coastal monitoring, research, and assessment activities and to ensure that data collected by EMAP and the NOAA Status and Trends Program augment and complement each other to the maximum extent possible.

The mechanism for cooperating and coordinating monitoring and research activities between NOAA and EPA's research program is a joint Committee for Coastal and Estuarine Environmental Quality Monitoring. This committee was created to ensure coordination and exchange of information between the two agencies on coastal monitoring, research, and assessment. The joint committee has held

monthly meetings since October 1989. The purpose of these meetings has been to exchange planning information and to identify opportunities for joint, complementary monitoring, research, and assessment activities. As a result of the activities of this committee, a joint NOAA/EPA quality assurance program will be implemented for the 1990 EMAP Near Coastal Demonstration Project. Through the joint committee, NOAA has assisted EPA in the development and evaluation of coastal and estuarine environmental quality indicators by participating in workshops, providing data for retrospective analyses, and reviewing EPA plans and analysis results. The joint committee has recently developed a Memorandum of Understanding (MOU) that defines continued interagency cooperation and interaction, and provides a framework for integrating the activities of the NOAA Status and Trends and EMAP Near Coastal Programs into a unified national monitoring and assessment program for near coastal waters. A draft of this Memorandum is currently being reviewed by each Agency's management.

The extent, type, and ecological condition of adjacent terrestrial and aquatic ecosystems has a major influence on the amount and type of pollutants that are released into coastal waters. Therefore, it is critical that interagency cooperation and coordination on monitoring, research, and assessment not stop with the activities of the joint NOAA/EPA Committee for Coastal and Estuarine Environmental Quality Monitoring. To ensure the protection and effective management of all the nation's ecological

resources, these activities must be extended landward to incorporate other agencies and ecosystems. Then environmental decision makers will have the truly integrated ecological monitoring, research, and assessment program required to address the complex, multimedia environmental issues of the 1990's and beyond. We are optimistic that this coordination can be achieved, based on the interactions among agencies this year.

In recent reviews of marine and estuarine monitoring programs the Marine Board of the National Research Council (NRC) and the EPA Science Advisory Board (SAB) concluded that the integrated monitoring and assessment information needed for protecting and restoring near coastal ecosystems was currently not available. The Marine Board and SAB reviews recommended the creation of a national network of regional monitoring, research, and assessment programs for near coastal environments. In addition, the Marine Board review recommended that this program include both NOAA and EPA and be designed in a manner that would incorporate and contribute to development of the EPA's National Estuaries Program (NEP). Finally, we will also be examining how to incorporate the National Estuarine Research Reserves, such as Prudence Island in Narragansett Bay, and the National Estuaries Program into the future framework. We have taken these recommendations seriously and are making progress on meeting them.

The Marine Board review also proposed a conceptual framework for monitoring, research, and assessment systems. This framework was used in the development of the EMAP Near Coastal program to ensure the concerns identified by the Marine Board were addressed. Two of the committee members that authored the Marine Board report entitled "Managing Troubled Waters: The Role of Marine Environmenal Monitoring" participated in a peer review of the EMAP Near Coastal Program. While we have not been able to fully address all the recommendations of the Board in the first year of our efforts, these scientists will continue to serve as technical advisors for the EMAP Near Coastal Program to ensure integration of the Marine Board's recommendations into EMAP Near Coastal efforts.

There is a need to insure the longevity of the mutually beneficial interactions that have been initiated between the EMAP Near Coastal and NOAA Status and Trends Programs. These joint activities provide an opportunity to develop a formula for defining and developing the interagency monitoring, research, and assessment activities required to address the complex environmental problems of the 1990's and beyond.

Mr. Chairman, you asked that I comment on H.R. 4030, the Coastal Zone Act Reauthorization Amendments of 1990, and H.R. 4115, the NOAA Ocean and Coastal Program Authorization Act of 1990. EPA's position on H.R. 4030 is fully set forth in the attached

prepared statement of LaJuana Wilcher, our Assistant Administrator for Water. We defer to NOAA on H.R. 4115.

Mr. Chairman, that concludes my prepared statement. I would be pleased to answer any questions the Subcommittee may have.

STATEMENT OF
LAJUANA WILCHER
ASSISTANT ADMINISTRATOR, OFFICE OF WATER
U. S. ENVIRONMENTAL PRCTECTION AGENCY
BEFORE THE SUBCOMMITTEE ON
OCEANOGRAPHY AND GREAT LAKES
OF THE
COMMITTEE ON MERCHANT MARINE AND FISHERIES
U. S. HOUSE OF REPRESENTATIVES

March 22, 1990

Good morning, Mr. Chairman and distinguished members of this Committee. I am LaJuana Wilcher, Assistant Administrator for Water, of the U. S. Environmental Protection Agency. I am accompanied by Tudor Davies, Director for the Office of Marine and Estuarine Protection, and Martha Prothro, Director of the Office of Water Regulations and Standards. We are pleased to appear before this Committee today to support reauthorization of the Coastal Zone Management Act (CZMA) as embodied in the Department of Commerce proposal. We have developed with the National Oceanic and Atmospheric Administration the basis for an ongoing dialogue to ensure that the programs established under the CZMA and the Clean Water Act (CWA) can work together to protect and manage our Nation's coastal resources. I would like to share with you this morning some of the results of that dialogue, as well as present you with EPA's views on the water quality issues that arise as part of the reauthorization process.

INTRODUCTION

The Administration has prepared proposed legislation reauthorizing the CZMA, and this Committee has introduced H.R. 4030 as its proposal. We have reviewed both of these proposals, and have been working with NOAA to ensure closer coordination between our Clean Water Act programs and the Coastal Zone Management programs and authorities, in light of the changes being suggested in the proposals. The Administration has reservations about H.R. 4030 and opposes certain provisions of the bill as indicated below.

With that in mind, I would like to reiterate some guiding principles that we have shared with you in the past. These principles focus on our current water authorities, and reflect factors we view as important in designing an overall strategy for protection of coastal resources:

- The Clean Water Act (CWA) and the Marine Protection, Research, and Sanctuaries Act (MPRSA) are basically sound statutes that provide EPA and the States with authorities to address most traditional marine and coastal sources of surface water pollution. Our strategy is to ensure that current levels of controls on these sources are maintained, while recognizing the special opportunities provided by the land and water use authorities established under the CZMA.

- Any new provisions affecting our programs should be designed to fill gaps in the protection and restoration of coastal waters, wetlands, and other aquatic habitat. They should focus on geographic targeting of activities on valuable coastal areas that already exhibit significant water quality problems or aquatic habitat loss, and waters that are threatened and in need of protection. In many such areas with degraded waters, we have found that water quality is impaired not by traditional sources such as industrial and sewage treatment plant discharges, but by non-traditional

sources of pollution (such as nonpoint sources, combined sewer overflows, and stormwater discharges) for which baseline controls are not yet in place. Our immediate concern in these areas should be to implement controls for the non-traditional sources, while maintaining, or, as necessary, improving, the current controls on traditional sources. Many of the controls on non-traditional sources relate to the land use authorities at State and local levels to carry out coastal management programs.

Where violations of water quality standards continue after controls on non-traditional sources are implemented, more intensive assessments of water quality and the sources should be conducted. Waste loads from all point and nonpoint sources should then be allocated among all sources on the basis of water quality, and follow-up monitoring should be conducted periodically to ensure that the water quality standards are met. This will also provide information to help evaluate the effectiveness of the nonpoint source controls (BMPs) for use elsewhere.

- Problems--and solutions--vary from watershed to watershed. Any new provisions of the CZMA, the CWA, or the MPRSA should allow sufficient flexibility for State and local authorities to design and implement regional and local solutions to regional and local problems.

- Protecting our coastal resources is not an easy task, nor will it be inexpensive. We welcome the assistance and expertise that Coastal Management Agencies and others can bring to bear on the problems, and will continue our work on developing a comprehensive Federal Coastal and Marine Policy that embraces other Federal Agency participation as well.

We think this overall strategy makes sense because it is both environmentally sound and cost-effective. The Committee may want to review H.R. 4030 with these basic concepts in mind.

SHARED RESPONSIBILITY FOR PLANNING FOR COASTAL RESOURCE PROTECTION

To keep my comments brief and to the point, I will talk first about the planning provisions in H.R. 4030, then about implementation, and last about meeting the needs of the future.

The bill, as drafted, has several planning and program development components, including separate provisions to address management of land uses affecting coastal water quality and improvements that are in the national interest. The bill also specifies that coastal management agencies should coordinate closely with State and local programs developed under the Clean Water Act, such as nonpoint source (NPS) control programs and the National Estuary Program (NEP).

We agree that program "coordination" is absolutely essential, so that there will be no conflict or overlap between programs developed under the Clean Water Act and programs developed under the CZMA. But coordination is only a small part of what we are striving to achieve. We want to forge a sound long-term working relationship between coastal management and water quality agencies at the Federal, State, and local levels to combine our efforts to protect and restore coastal resources. To achieve this broader, long-term goal, any new requirements placed on States should be designed to build upon and enhance earlier State CZMA and CWA management efforts, leading to higher quality management and long-lasting goodwill between the State agencies responsible for implementing the CWA and the CZMA.

In short, we are charting new territory for State water quality agencies, which have historically seen their role as having sole responsibility for preventing and controlling sources

of pollution to all surface waters. We welcome an increased emphasis on water quality and ecological protection as part of the CZM programs' mission, because it provides the opportunity to integrate land management and water quality management in the area of the Nation where the resources are under perhaps the greatest stress. We want to ensure the successful integration of the two State program efforts by establishing meaningful program requirements that lead to strong, clearly defined water quality and coastal management partnerships at the State level.

SHARED RESPONSIBILITY FOR ACTION TO PROTECT AND RESTORE COASTAL RESOURCES

Keeping in mind the overall strategy I described above, and the need for close coordination and clear definition of roles at all levels of government, I will now turn to implementation. Under the Clean Water Act, EPA is assigned responsibility for developing water quality criteria to ensure the biological, chemical, and physical integrity of our Nation's coastal resources. State water quality agencies then adopt these criteria into State water quality standards. These standards form the backbone of our surface water programs, and we are pleased to see that the proposed legislation reinforces the traditional role State water quality agencies play in this area.

Likewise, State coastal management agencies have long-standing authorities and expertise in dealing with State and

local land use issues. State coastal management agencies can use these skills to work with State and local authorities to develop and implement coastal land use management measures that will assist in preventing or controlling the individual and cumulative impacts of nonpoint source pollution on aquatic resources and habitat. This work will augment and complement State water quality efforts to implement structural and non-structural Best Management Practices (BMPs) for nonpoint source prevention or control, and the efforts of National Estuary Program Management Conferences to develop comprehensive coastal water quality management plans with full involvement of concerned Federal, State, and local authorities.

State coastal management agencies also have the limited capacity to acquire land. In preventing or controlling nonpoint source pollution, buffer strips, preservation and restoration of wetlands, and other forms of land management can be extremely cost-effective solutions that serve multiple purposes--including preservation of designated water uses, protection of aquatic habitat and economic development. Again, this is an area in which coastal management agencies can provide valuable assistance to water quality agencies in our mutual efforts to prevent or control nonpoint source pollution.

Finally, the coastal zone management program has encouraged many States to develop coastal habitat protection programs,

including regulation of activities taking place in coastal wetlands and other coastal waters. However, the level of protection provided by State coastal wetlands programs developed under the CZMA varies considerably, and we think that including wetlands as a special national interest area will encourage State coastal management agencies to complement efforts EPA has underway to support more comprehensive State wetland protection and restoration programs. In addition to enforceable policies for wetlands protection, we would also stress the importance of State incentive programs.

SHARED RESPONSIBILITY FOR ADVANCEMENT OF KNOWLEDGE IN DEALING WITH AQUATIC ECOSYSTEMS

To ensure additional water quality gains in the future, EPA is continuing to develop many of the "tools" that the States and local water quality agencies need to control non-traditional discharges in these coastal areas. These "tools" include new BMPs, improved water quality criteria and standards, more sophisticated techniques for apportioning loads among point and nonpoint sources, new technologies for restoring and creating wetlands, and improved ways to express violations of water quality standards or use impairments. The coastal management program contributes to our common "pool" of knowledge through its estuarine research reserves, which provide field laboratories. Linking the experiences of CWA and CZMA agencies in these areas will accelerate our ability to provide States and local

governments with new and more effective tools to protect aquatic resources and habitat.

Monitoring is vital to the efforts of both State water quality and coastal management agencies. Under the Clean Water Act, States are responsible for monitoring water quality and identifying waters not meeting water quality standards. However, State monitoring programs must be sufficiently supported in order to carry out the level of monitoring needed to identify and characterize water quality problems (including habitat integrity), develop practicable non-traditional control options, and implement controls on the basis of water quality. This is complex, sophisticated, resource intensive work that is beyond the capacity of many State monitoring programs today. Regional or area-wide monitoring programs now being implemented by EPA's National Estuaries Program and by NOAA's National Estuarine Reserve Program are expected to help meet these needs in the future. In addition, EPA's Environmental Monitoring and Assessment Program is getting underway an environmental assessment of long-term Regional trends in coastal areas.

In addition to problem identification, however, there is a need for ongoing monitoring to determine conditions and trends in coastal and marine waters and wetlands where controls are fully implemented--work that EPA and State water quality agencies are not currently equipped to do. The Committee may want to consider

ways to leverage State CWA monitoring efforts with those of NOAA to forge a meaningful partnership with sufficient support to cover the entire spectrum of monitoring, including problem identification, evaluation of the effectiveness of controls following implementation (particularly nonpoint source BMPs), and determining the need for additional, water quality-based controls.

Finally, we are discovering that citizen coalitions can provide valuable monitoring support that government agencies cannot provide. Currently, both DOC and EPA support volunteer monitoring activities, although the CZM program through its estuarine reserve program is particularly well-suited to support and promote these efforts through its established links with local environmental interest groups. Both water quality and coastal management agencies will continue to mobilize citizen monitoring efforts to augment those provided by governmental entities, working cooperatively to ensure high quality data, compatible approaches and rapid information exchange.

CONCLUSION

Mr. Chairman, we are pleased to support the Department of Commerce proposal to reauthorize the Coastal Zone Management Act and believe the Administration's bill meets our goals and objectives in reauthorization. We have made progress with the States and with our colleagues in NOAA in defining our respective

roles and responsibilities to protect and restore coastal resources. The reauthorization provides a greater opportunity for cooperation and coordination of our programs.

Mr. Chairman, that concludes my presentation. Thank you for the opportunity to be here with you today. We will be pleased to respond to any questions that you or members of the Committee may have.

Mr. NOWAK. Thank you very much. Both of your statements will be totally incorporated in the record.

Mr. Ehler, let me just ask a couple of brief questions. We have prepared questions that we are going to submit to you in writing because of the Mandela speech. But you had stated, I think, either in your testimony or in your oral remarks that the expanded NERRS program began in 1989 and there would be—that there are, I guess, three phases in the monitoring program.

What year, or when would you expect to anticipate that you would be into phase three in that program?

Mr. EHLER. Mr. Chairman, I believe there is one estuarine Reserve that is about to launch into a long-term data collection and field monitoring program. That is the Tiajuana Reserve. There are certainly others that are going to follow close behind. I think we are talking about something that is developing as we speak, and that capability is going to evolve fairly rapidly.

Mr. NOWAK. How does NOAA intend to enhance the NERRS monitoring program in the near future?

Mr. EHLER. Sorry?

Mr. NOWAK. How would you anticipate you are going to be able to enhance the NERRS monitoring program in the near future?

Mr. EHLER. I think that the obvious answer to that one is that the first phase of this is to improve our own guidance and internal management of that program so that we can give clear direction to the individual estuarine Reserves in the development of their program, particularly from the standpoint of being able to develop from such a program, information that is comparable across estuarine Reserves, so that these various systems or sites within a system can learn from the data collection and the information generation and the research results that come out of such a program. There are, obviously, resource issues as well, in terms of providing resources to these sites so that they can conduct such a program.

Mr. NOWAK. Let me turn to Mr. Skinner. Do you think that there are at the present time any overlaps between the monitoring sites of your program and NOAA's program? And you mentioned memoranda of agreements. How are we going to coordinate? (You know, that has been, I guess, the outstanding question), to bring the most effective program we can, the most efficient for the dollars we are spending.

Mr. SKINNER. Yes. To the extent that we can use the monitoring data from the NOAA Status and Trends Program and data that might be collected through the Research Reserves program, we will use that data. And we will sit down with NOAA and work out the protocols for collecting information so that it can serve both purposes. We will not duplicate monitoring where that is unnecessary.

Mr. NOWAK. When will EPA report on the status of our coastal estuarine systems? When is that going to be?

Mr. SKINNER. This year we're doing a demonstration project to demonstrate the techniques for collecting the data and working out all the quality assurance and quality control. After that, routine monitoring will be set up, and it will be approximately two to three years before reports can be put out on a continued basis.

Mr. EHLER. Mr. Chairman, can I just interject on that one?

Mr. NOWAK. Sure. Go right ahead.

Mr. EHLER. Relative to what we know about the status of coastal areas, I think those of us who have participated over the last seven years in the development of NOAA's National Status and Trends Program recognize that it is inadequate to accurately characterize the entire coastline in detail from the results of measurements at only 300 locations. That is a monumental task to try and do this and we have done what we can with resources that are available to this NOAA program.

We have, however, already issued a sizable number of reports. I mentioned 75 scientific reports in our library already that document the results of NOAA's efforts, and about half a dozen of those reports, I think, can truly be said to represent at least initial efforts toward characterizing the status, and over the last several years, trends in the levels of chemical contamination in coastal areas of the United States. So I would say that we can already characterize that at the national level. I think we will—our ability to do that will improve significantly as we add sites and learn how to use these data more intelligently, and I think as we cooperate more fully in the future with the Environmental Protection Agency in some of our joint measurement and assessment activities, the Nation's abilities are going to improve significantly; to be able to say what's going on not only now, but be able to begin to predict what is likely to happen in coastal areas over time.

Mr. NOWAK. You did both touch on this and probably it is a little sort of a side issue here, but I think a very important issue, is what we are doing in the fish inspection area, totally? What is coming out of these estuaries? You mentioned the clam and oyster problem, and we look now at the sport fishing industry, not only in the saltwater, but certainly in the Great Lakes, where you have throughout the country, each State advising.

And I am wondering if you can see down the road this research adding to that body of knowledge, to take some of the "guesstimate" out of that procedure. There has been to my knowledge, not any real scientific research done, on what type of contamination is contained in these fish that are caught, except in very general terms. There are fish "advisories" and each State, or on the Great Lakes anyway, makes their own assessment of that and some of the environmental groups, of course, have questioned those assessments in looking at some of the past studies that have been done in the—it isn't the examination of the bottom-feeding fish that are in these areas that—we talked about estuaries, and I guess in the Great Lakes, the rivers and streams that are flowing in provide a great wealth of the breeding area for the game fish.

And where are we in terms of looking at that and trying to provide, you know, good, scientific based information as to what those warnings should be?

Mr. EHLER. Again, I think we're already down the road. We're not starting from square one on many of those issues. Chemical contamination of fish has been a routine measurement of our Benthic Surveillance Project, part of the National Status and Trends Program, since 1984. NOAA has had several other efforts to go out and initiate measurement programs of chemical contamination in fish. They have had a sordid history and I'd be happy to provide you with additional information on that if you would like.

But we certainly know, I think, a significant amount about the levels of contamination. I think there is a significant amount of research that is still to be carried out from the standpoint of the effects of various levels of chemical contaminants on fish both in terms of the health of the animals, the health of various populations of these animals. They are important for commercial and recreational purposes, and certainly from the standpoint of public health, effects of the consumption of contaminated seafood.

Mr. SKINNER. Let me comment with respect to areas where I think research could best improve our ability in that area. With respect to any individual fish, you could do a chemical analysis and determine what the levels of various constituents are in it, but you don't necessarily have the ability to translate that to the entire species and to determine whether or not an entire species is declining or increasing or whether any fish caught on any particular day would be in danger. So you need a statistically designed monitoring system in order to make those sort of assessments, and you need better indicators of the health of ecosystems and research into indicators of what specific measurements would be able to tell you that the health of a particular ecosystem is very, very important and that would be part of our program.

Also, translating that information to the sources of contamination so that control measures can be put in place requires research into modeling and monitoring of ecosystems so that you can put your control programs in place that will lead to reductions in those levels. All of those areas are very important for research.

Mr. NOWAK. The program that you are designing and your memorandum, does this include the State DECs or whatever agency in the State that would have the corresponding responsibility? How do we coordinate that State effort in your program?

Mr. EHLER. I think the linkage between and across Federal and State programs is absolutely essential. The Marine Board of the National Research Council report does come up with a number, something on the order of $133 million, I believe, that is spent on monitoring programs in the United States every year, most of that on compliance monitoring as opposed to the types of programs that we are talking about in the National Status and Trends Program and the EMAP Program. But about half of that money, or I think at least $52 million or $53 million is spent by State and local governments. So there is a considerable effort that is going on in this country to collect that type of information and we have to learn how to use it more intelligently in the context of the Federal programs.

The contribution the Federal programs can make is that we tend to do the field work and the analysis of data in a uniform manner across the country. The Marine Board correctly pointed out, and I think we already knew that the disadvantage of local programs is typically they do things quite differently from one place to the next. It is very difficult to compare that information, and I think we need a well-coordinated Federal, State and local effort so that we can make the best use of very limited resources to go out and organize and collect information in a way that will be comparable across these various places.

There are certainly local problems that have to be addressed through local monitoring programs. But we have to learn how to more intelligently coordinate these programs to make them more consistent across one another, and to make best use of the results of those kinds of efforts.

Mr. SKINNER. I agree with that, and we would do that in EPA working through our National estuary program and working through our regional offices. And the EMAP program is being designed so it can be brought down to resolution at the State level so they could do similar monitoring statewide and that we could aggregate the data at the national level so we can get national monitoring trends indicators.

Mr. NOWAK. Mr. Skinner, you mentioned in your statement that you plan to begin using satellite imagery for the EMAP program. Do you plan to use the Landsat satellite data or will you be using the NASA data from their planned Earth Observatory System?

Mr. SKINNER. We are looking at both—

Mr. NOWAK. How will we obtain the data?

Mr. SKINNER. We are looking at both of those systems. Originally, we will be using the data to characterize the landscape in the various monitoring locations, characterizing from aerial photography and also from satellites the landscape in the monitoring areas. Over the longer term we are developing—hoping to develop indicators of the ecological condition that could actually be measured from a satellite or from an aircraft, and we believe that the Mission to Earth Program of NASA, the Earth Observing System, the EO System, offers tremendous potential and we'd like to incorporate those types of measurements into that system.

Mr. NOWAK. Let me turn to our colleague Lamar Smith for any questions he has at this time.

Mr. SMITH. I don't have any questions. Thank you, Mr. Chairman.

Mr. NOWAK. One other, you know, area where we talk about the relating of all of this research to some basic health advisories, I think when we get through, you know, this initial monitoring we have to, you know, look at, of course, fish and wildlife. And all the State agencies come into heavy play because they have "the responsibility to guide the general populace." And we're telling everybody, you know, stop eating beef, don't eat eggs anymore. We're changing our diets. Eat fish. And the increase is, you know—yes, is very, very large—20-22 percent increase in consumption every year now. And yet, it doesn't seem to me the scientific community is putting enough effort to—they had a little symposium at the University of Buffalo, where they brought in toxicologists and epidemiologists to try to see what they could agree on as far as the health effects on humans. And they, you know, went around the table, trying to find what—what really they just could basically agree on. And I guess this is a problem throughout the country. That we don't have that, you know, that basic agreement by the professionals and by the scientists. And, if we don't have that, and if we don't coordinate that federally, you know, it will just be out there and you will be dealing with individual little problems and never be able to really manage or give the States, you know, any guidance as to where they could be going and how to effectively manage

these programs. So I hope that as you go along, you know, that can be better defined out there.

Do you have any—have you talked to the scientific community?

Mr. SKINNER. Yes. We are very familiar with the problem. In addition to an ecological research program at EPA, we also have a human health research program which attempts to determine and pull together and coordinate all of the information being collected worldwide on human effects of various pollutants. And we go through all of the available information and the literature, and we have a system called the Integrated Risk Information System, which is the clearinghouse of all health data with respect to environmental pollutants. And it is by the peer review that we go through in putting that information into the system, that we try to resolve the inconsistencies in the data that is out there, and then identify additional research that needs to be done in order to carry out—in order to resolve some of those questions.

So we are aware of the problem and we think it's a very important issue to resolve.

Mr. NOWAK. You know, within this whole area too, you mention that you are looking at "trends" as our population moves to the coastal area States. That's increasing, I guess, every day. How long do you think does it really take to establish "a trend"? What are you looking at that being?

Mr. EHLER. There is no simple answer to that question because it depends precisely on what you are trying to examine. I think that within NOAA, and the Status and Trends Program in particular, we have made no attempt to begin to publish trends information until after we had completed the fourth or fifth year of our program. I think you have to make that investment, and in order to intelligently interpret trends in environmental contamination or ecological health one has to make a commitment to carry out these programs over a long period of time. "Long" probably being an indefinite period of time from the standpoint of at least some of the parameters that are most important in making these measurements.

Mr. SKINNER. Yes, I agree with that. The long-term monitoring is very important. I think you are talking about monitoring over periods of decades to ascertain trends.

Mr. NOWAK. And we have spent some, I guess, $58 billion on secondary treatment. And going through some of the areas that haven't achieved that, we looked at some of the East Coast and certainly some of the West Coast areas. And we have different problems in the Great Lakes because of the amount of water that is consumed. That water is used and, as you know, treated, and supplies that population with fresh water. Do you see any need for different types of research in those two areas? When you talk about a saltwater environment which is producing, I guess, vastly different amounts of the breeding that supplies our whole fishery, commercial fishery out there.

Mr. SKINNER. Yes. The research would be different in terms of the sources that are causing the pollutant. It would be different in terms of the species that would be affected by it, and just the entire ecosystem is a different ecosystem. Therefore, you need to tailor your monitoring program to those particular regions.

Mr. NOWAK. But that will be done and is being done?

Mr. SKINNER. That will be—over the long term we will move to all ecosystems starting with coastal waters, moving to Great Lakes, and then moving to agricultural and forest systems in the future.

Mr. NOWAK. Let me turn to Claudine Schneider for her questions.

Ms. SCHNEIDER. Mr. Chairman, the witnesses have been so thorough in their presentations and you so comprehensive in your questions there is hardly anything remaining for me to ask, but I will try with one small question. That is, to what degree are you—both of your agencies involved in the training and the providing of equipment to, for example, citizens groups to assist you in the monitoring process?

Mr. EHLER. I think in our case since we have been in this business for six years and do not have what we consider to be obs—well, I shouldn't say obsolete, but old equipment that we typically have passed down in other areas of oceanography to citizens groups to develop local monitoring efforts. In physical oceanography, for example, we constantly loan out things like tide gauges to citizens groups, and other local interests to help themselves and us on some of those kinds of problems.

The answer to your—the direct answer to your question is we have not done any of that. I think that we would consider doing that in the future, just as we have done in these other programs.

Ms. SCHNEIDER. And you don't need me to legislate such a thing? You'll do it on your own.

Mr. EHLER. I don't think we need a law requiring us to do that. We do that pretty much as a normal course of doing business.

Ms. SCHNEIDER. Well, I think that as we look at the squeeze that is being put on all of our Federal budgets and we also look at the increased sensitivity and the consciousness of the grassroots and their willingness to participate through organized citizens groups in helping to improve the quality of our environment—I think that if we merely as a government can provide them with support through tools and training, they can help us do this job. After all, we are all in this together. And I think that your initiatives to reach out to those citizens groups would be very cost effective.

Mr. EHLER. I agree completely with your intent. I would say that the only caveat to that is that for the most part, particularly in the kinds of Federal efforts we are talking about here, we are talking about very sophisticated measurements, using very sophisticated technology.

Ms. SCHNEIDER. Right.

Mr. EHLER. This is high quality, state-of-the-art stuff, and I think that one of the strong points of the program is that we are working on the cutting edge on many of these measurements. The citizen is simply not prepared—

Ms. SCHNEIDER. I understand.

Mr. EHLER. —to utilize some of this technology. On the other hand, I think there are certainly types of measurements and indicators and alerts that local citizens can provide to State and Federal agencies that would help us understand better what types of measurements we should be making, where we should be looking,

what kinds of emergencies that may be developing, and trends that we simply can't see when we operate from the national level.

Mr. SKINNER. I certainly agree with the need for incorporating citizens' monitoring into these efforts. Under the National Estuaries Program, on some of the projects we are doing demonstrations or pilots of citizen monitoring, and we are also going to establish a clearinghouse or directory of citizen monitoring efforts so that they can exchange the information.

Ms. SCHNEIDER. Great. Terrific. I have no further questions, Mr. Chairman.

Mr. NOWAK. Thank you very much. We will have just a couple of minutes here, and let me ask, you know, everybody—please, after your initial three months here we will have all the information we need and we can start to solve these problems. I am just wondering, in your review of this, how many years, how long will the sampling take to identify the differences between natural variability and human-induced changes as a result of pollution loadings that come from this coastal environment that you are looking at?

Mr. EHLER. I think that is one of the toughest questions that we face in the scientific community, and that is, sorting out natural variability from changes that are induced by human activities. I think we know, again, a considerable amount about that and I think a lot of the work that we are doing in both of our agencies is contributing to reducing the uncertainty about what we know of those differences. I think it is a question that we are going to be working on for a long time to be able to answer from a national standpoint, and to be able to help design, again, more intelligent national strategies to clean up these areas.

I think if we are talking about local and regional programs, programs that are specific to a certain estuary, given the investments that have been made in systems like Chesapeake Bay and Puget Sound and a number of other places, Narragansett Bay certainly, we are talking about a lot more uncertainty—I mean, a lot more certainty about what we know in terms of natural variability. But it's still very much an open question for most of the places around the United States.

Mr. SKINNER. It clearly depends upon the pollutant and the ecosystem. But I think that there is some hope here, and let me give you an example. With respect to pH levels in lakes that might be affected by acid deposition, we were able in a monitoring program over the course of three to four years to be able to determine the impact from man-made sources. So, if it is a fairly simple measurement that is being made, it can be sorted out in that period of time. If it is a more complex measurement, and the sources are more complex, it would take longer than that.

Mr. EHLER. An example that might be more germane to coastal problems is, of course, eutrophication, nutrient overenrichment of coastal waters, which is certainly one of the largest problems that we face. And quite frankly, there is a good example of where, for most of the estuaries in the United States—again, there are certain exceptions to that, but in most of the estuaries we have a very difficult time sorting out natural variability from human-induced nutrient inputs.

Mr. NOWAK. You mentioned the acid deposition. What has been the effect of and how successful has the liming of the lakes been on that problem?

Mr. SKINNER. On individual lakes that could be effective. I think as an overall solution on a nationwide basis we don't think that that is something that would be effective on a wide scale. But on individual lakes you can bring them back depending upon the degree of alkalinity and the condition of the lake.

Mr. NOWAK. A lot of the Great—or the lakes up in New York and up to Vermont, I guess, have been successfully limed. Does that process go on every year? Or is it—it depends on the testing, I guess.

Mr. SKINNER. Yes. It depends upon the testing. It depends upon the alkalinity of the lake to start with, as to whether you need to apply it on a continuous basis or whether just an initial application would be effective.

Mr. NOWAK. After that liming is completed, are there any other side effects that don't help the total situation?

Mr. SKINNER. Not that I'm aware of. And you, obviously, have to be concerned about the additional deposition that would take place in the future, so it may not just be a one-time application.

Mr. NOWAK. Well, thank you very much. We're going to have to go over to the House in a minute to see Nelson Mandela. But we appreciate your patience and we will get back to you. We have a series of other questions we would like to have for the record, especially for the other members. Thank you again for attending.

We will adjourn until, I believe, about 12 o'clock? Is that satisfactory? We'll adjourn till 12 o'clock and then go right into panel two. Thank you.

[Recess.]

Mr. NOWAK. The subcommittee will come to order. We'll resume our hearing with our second panel.

And let's see, the panelists are here. We have Gene Wright, who is the President of National Estuarine Research Reserve Association and Director of the Old Woman Creek National estuarine Research Reserve, Huron, Ohio.

And, if you would like to begin, we will then go down with the other panelists, Mr. Wright.

STATEMENTS OF EUGENE WRIGHT, PRESIDENT, NATIONAL ESTUARINE RESEARCH RESERVE ASSOCIATION, AND DIRECTOR, OLD WOMAN CREEK NATIONAL ESTUARINE RESEARCH RESERVE, HURON, OHIO; STEPHEN R. BLIVEN, REPRESENTATIVE FOR COASTAL STATES ORGANIZATION, AND ASSISTANT DIRECTOR, MASSACHUSETTS COASTAL ZONE MANAGEMENT OFFICE, BOSTON, MASSACHUSETTS; CHRISTOPHER N. K. MOOERS, PROFESSOR, INSTITUTE FOR THE STUDY OF EARTH, OCEANS AND SPACE, UNIVERSITY OF NEW HAMPSHIRE; ALLAN D. BECK, MANAGER, NARRAGANSETT BAY NATIONAL ESTUARINE RESEARCH RESERVE, PRUDENCE ISLAND, RHODE ISLAND; CARROLL N. CURTIS, DIRECTOR, CHESAPEAKE BAY NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM IN VIRGINIA, GLOUCESTER POINT, VIRGINIA

Mr. WRIGHT. Mr. Chairman, and subcommittee members, on behalf of the National Estuarine Research Reserve Association, thank you for giving me the opportunity to present our views on the reauthorization of the Coastal Zone Management Act and, in particular, on section 315, which deals with the National Estuarine Reserve Research System.

In light of the excellent comments that you provided at the beginning of this session and earlier colleagues, I will skip through my written testimony and perhaps target on some of the areas that might be more informational to you today.

In slightly more than a decade, the NERR System has grown to encompass 18 Reserves that protect nearly 300,000 acres of estuarine waters, tidal wetlands, and shore land in 16 States and Puerto Rico. And you've already heard that eight of the designated Reserves presently have on-site visitor centers and research monitoring facilities. The total Federal investment in the NERRS Program thus far has been $36.6 million. I think you would agree that this represents a pretty good return on dollars invested.

With 13 more sites presently under consideration, 350,000 acres may be added to the system in the near future. More than 200,000 of these acres will be provided through individual State commitments to the system with no Federal investment required. Consider in 1979, with only five Reserves designated, actual appropriations of $3 million, last year with 18 Reserves and only $3.4 million actually appropriated, it is obvious that the Federal commitment is not keeping pace with State investments.

My written comments, previously furnished to you, presented data that supports NERRA's opinion that States are carrying a disproportionate financial burden. We cannot afford to continue this practice if we are to meet the goals and objectives of the program.

We are not asking for a hand-out. We are simply requesting a hand to relieve some of the financial pressures we are feeling at the State level. Once again I refer you to my written comments in which NERRA has assessed Federal funding needs and some selected tasks that we could accomplish if we had the money to do so.

Now I would like to move on to topics you specifically requested that I address today. Consider, if you will, before I start this portion, that individual Reserves are in various states or stages of development; therefore, not all 18 are up and running, so to speak,

and performing all of the research, monitoring and education activities that the potential is there for, but several are. And, by way of example, drawn from my own 12 years' experience at Old Woman Creek, I thought maybe I could give you some feel for how we are really forming our job—or performing.

First question you asked what are the abilities of Reserves to provide data useful to local and State coastal resource managers and decision-makers? Old Woman Creek began our water monitoring program over 10 years ago. During that time we have sampled more than 10 sites, 20 parameters of water quality. Data used from this monitoring program has provided the basis for a recent research project undertaken by our own Reserve staff in which we determined that our estuary is able to retain up to 60 percent of the metal and up to 80 percent of biologically important nutrients within the estuary during storm events. Without that kind of database, we would not have carried out this sort of monitoring and research.

During the same number of years we have been monitoring the impacts of highway construction through the estuarine wetlands, and over this time our database and information we have shared with the Department of Transportation. We have recently learned that—in fact, their environmental scientists told us that had they known what they presently know after our studies over the years, they never would have constructed such a highway through this type of wetland, and this information is now being used by Department of Transportation in the continuation of this highway through Ohio.

A cooperative long-term monitoring project that is currently under way, just begun this year, with agencies of the United States Department of Agriculture, the Ohio Department of Natural Resources, the Erie County Soil and Water Conservation District, and landowners in the Old Woman Creek watershed are looking at a watershed-wide, nonpoint source pollution project. The objective is to improve watershed water quality by using best land-use methods to decrease losses of soil through run-off and to reduce phosphorus, nitrate and sediment loads in the streams and estuary.

We are also very concerned about housing subdivisions and their impacts on the water quality, so we have commenced a part of the program to investigate these. Of course, it will take several years to formulate some body of knowledge that will help us better manage the watershed.

Recently we cosponsored a Priorities for Great Lakes Coastal Wetlands Research with the Ohio Department of Natural Resources, the Ohio Sea Grant, and the U.S. EPA. Sixty-one participants from various State and Federal agencies from throughout the region came to Old Woman Creek and, after two days, formulated some priorities that we think are important for the coming decade in monitoring and research of the Great Lakes, and those proceedings will be available very soon.

Another area we've worked on, largely because of our long-term monitoring database that we already have and the protected site, is zebra mussel research. That is a hot topic, so to speak, in the Great Lakes. And at the present time we are prepared to commence studies on the effects of zebra mussels on the plankton communities of

coastal wetlands such as Old Woman Creek estuary, contingent upon funding availability in the next two years.

The next question you asked was, How does NERRS coordinate with other Federal monitoring programs? In our case I can give you an example of this. In 1985 through 1987, the United States Environmental Protection Agency contracted with the U.S. Fish and Wildlife Service to conduct studies on cancer rates in bottom-feeding fish of the Black River. This river is located on Lake Erie and is one of the priority areas of concern in the Great Lakes.

In 1988, the study was expanded to determine the extent of polyaromatic hydrocarbon pollution in bottom sediments, its uptake in bottom-feeding fish, and incidence of liver cancer in these fish. Old Woman Creek Reserve has been used as the control area. Their staff have used our staff and our lab facilities and equipment to analyze samples, have used our boats and nets in the field, and utilized our dormitory facilities for overnight accommodations.

This year, the study has further developed into an interagency cooperative venture with the addition of a U.S. EPA field team who have joined forces with the U.S. Fish and Wildlife Service, the University of Michigan, and Ohio State University researchers to commence a bio-markers monitoring project using bottom-feeding fish as early indicators of water pollution. And, if you are interested, I have some correspondence that could be handed out to you relating to that project. And I'll leave it here in case you would like to peruse that later on.

Third question: What is the capability of NERRS to develop a sound national coastal monitoring program based on current funding levels or on increased levels if necessary, and how much will it cost? First of all, I don't think the NERRS monitoring efforts were ever intended to be "the one" national monitoring program. Although many of our Reserves have been carrying out a monitoring project for several years, MEMD has recently made monitoring a higher priority because they recognized the need to understand the National estuarine system that we as site managers are supposed to manage. In other words, monitoring for us in the field is a management tool. The Reserve Monitoring Program is not intended to assume the role of the U.S. EPA or other Federal programs. However, Reserve monitoring programs are able to enhance the ability of Federal agencies to manage estuarine ecosystems for several reasons, and I would refer you to page 6 of my written testimony to note several of the reasons we think that estuarine Reserves are unique in the entire national system of monitoring and research.

Perhaps the most important thing that you can do towards a national monitoring effort is to support ongoing Reserve monitoring that will not be tied to the political processes.

Someone has said several times today, how long and how much? Well, time is of the essence, but things take time. And, without long-term monitoring projects, we will destroy the validity of the scientific endeavors. Therefore, interfering with the process of really understanding estuarine ecosystems.

Also, perhaps the second most important thing you could do is to provide us with this critical time and money by moving forward towards reauthorization of the Coastal Zone Management Act at a

funding level that will enable our Reserve managers to do their jobs.

And I thank you for your consideration and look forward to answering any questions you may have.

[The prepared statement of Mr. Wright follows:]

NERRA
NATIONAL ESTUARINE RESEARCH RESERVE ASSOCIATION

TESTIMONY OF

EUGENE WRIGHT, PRESIDENT

NATIONAL ESTUARINE RESEARCH RESERVE ASSOCIATION

to the

SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH,

AND ENVIRONMENT

OF

THE HOUSE COMMITTEE ON SCIENCE, SPACE & TECHNOLOGY

JUNE 1990

Mr. Chairman and Members of this distinguished Subcommittee, I appreciate your permitting me to submit testimony on behalf of myself and my colleagues. My name is Eugene Wright and I am president of the National Estuarine Research Reserve Association (NERRA), as well as manager of the Old Woman Creek National Estuarine Research Reserve. NERRA is an association of on-site Reserve managers and other state Reserve staff of the 18 designated national estuarine research reserves and several other proposed reserves. I would like to present our views regarding the Coastal Zone Management Act Reauthorization Amendments of 1990; and in particular, Section 315 which deals with the National Estuarine Reserve Research System (NERRS).

THE NERRS SYSTEM

The 1969 report of the Stratton Commission is credited with the original vision for completing a network of research sites representing the various biographic regions and estuarine

ecotypes along our nation's coasts. Section 315 of the CZMA established, through an equally shared Federal-State cooperative effort, a national System of estuarine reserves (formerly estuarine sanctuaries) to provide opportunities for long-term resource protection, environmental research, education, and interpretation. Scientific and education programs were to focus on the development of information for improving coastal resource management decision making.

Today, after more than a decade of successfully managing our nation's National Estuarine Reserve Research System, NOAA's Marine and Estuarine Management Division (MEMD) administers a Program that includes 18 Reserves protecting nearly 300,000 acres of estuarine waters, tidal wetlands, and shorelines that represent many of the coastal regions and estuarine types of the United States. There are designated Reserve sites located in Georgia, Florida, Alabama, North Carolina, Puerto Rico, Hawaii, New York, California, Washington, Oregon, Maine, Ohio, Massachusetts, New Hampshire, Maryland, and Rhode Island. Although the original plan for 25-30 sites within the Reserve System is only slightly more than half complete, the System will soon be expanded to include new sites in Virginia, South Carolina, and New York.

However, designation is only the beginning! In order to fulfill the System goals of acquiring land and water, managing and operating on-site facilities for education and interpretation, and supporting long-term research and monitoring programs; a significant commitment is required by both the Federal and state governments. Section 315 provides for such a Federal-state partnership in development of the System by authorizing 50% matching grant awards through NOAA/MEMD.

Unfortunately the growth in state commitments has not been matched by the Federal Program. In nearly every instance, the Federal contribution is exceeded by state and private matching funds; often many times over. At Waquoit Bay, Mass., for example, NOAA/MEMD grants of $1.8 million were matched by nearly $10 million in state funds; at Wells, Maine, the Laudholm Trust has raised nearly $3 million for acquisition and site development; and in Ohio, the Department of Natural Resources has overmatched the Federal share of $457,000 for operations, research, and education with $786,000 during the past several years.

In 1979, when only 5 Reserves had been designated, actual Federal appropriations for NERRS was $3 million. Last year, with 18 designated Reserves, actual appropriations were only $3.49 million. It is obvious from these figures that the Federal government's commitment to the NERRS is not keeping pace with state investments, and in many instances this situation is

placing a disproportionate financial burden on individual Reserves. Steady growth in the number of designated Reserves has resulted in a System with sites at all stages of development, and Federal appropriations at current levels are just not enough to ensure that states will be able to successfully achieve the long-term goals and objectives of the Program.

The NERRA conducted a survey of Reserve managers in April, 1990 to determine how much Federal funding they feel is actually needed to carry out the mandates of the NERRS Program. A summary of their assessments of System-wide Federal support needs were:

Site development (facilities)	$1.57 million
Operations (equipment, utilities, maintenance, personnel, etc.)	1.68 million
Monitoring	1.00 million
Acquisition	1.62 million
Research grants	.80 million
Special projects	1.50 million
Education grants	.25 million
Site selection	.20 million
TOTAL per year	$8.42 million

Some examples of specific tasks mentioned by managers included:

Operations

Equipment

Alabama- boat, vehicle, lab. equip.	$60,000
Massachusetts- boat, truck, computer	65,000
New York- truck, trailer, computer	35,000
Ohio- fecal coliform testing equip.	5,000

Personnel

Maryland- education & research coord.	$73,000
New York- education & research coord.	73,000
Hawaii- education & research coord.	73,000

Total System-wide assessment= $1.68 million/yr.

Monitoring

Washington- hydrocarbons, seagrass	$50,000
Florida- mangroves, urban runoff	50,000
Ohio- watershed non-point pollution	35,000
California- seagrass, agricultural runoff	50,000

Total System-wide assessment= $1.0 million/yr.

Site Development	
Public facilities	
Maryland- visitor center	$900,000
Massachusetts- visitor center	840,000
Hawaii- visitor center	850,000
Research Support Facilities	
Washington	$500,000
Oregon	750,000
Alabama	340,000
Educational classrooms	
New Hampshire	$120,000
Maine	300,000
Oregon	200,000
Trail Improvements	
Alabama	$90.000
Massachusetts	90,000
Rhode Island	45,000

Total System-wide assessment= $1.57 million/yr.

These are our reasons for encouraging you to support our request for increased appropriations at the $7.0 million level for FY 1990, with incremental increases to $8.42 million in FY 1995; as currently contained in Section 315 of the Coastal Zone Act Reauthorization Amendments of 1990 (H.R 4030).

RESEARCH, MONITORING & EDUCATION FOR BETTER COASTAL MANAGEMENT

The principle objectives of the National Estuarine Reserve Research System are to acquire, develop, and operate a nation-wide system of Reserves for long-term scientific and educational programs that provide information essential to coastal management decisionmaking.

In response to the need to understand estuarine ecosystems and provide technical guidance for protecting its reserves, the NERRS has developed a comprehensive and coordinated program of estuarine research. Not only does it provide a data and information base relating to the management of research reserve sites, but the program also stimulates improved information exchange among other government agencies, industry, the academic community, and the general public.

The information gained through the NERRS research program, in which 170 projects have been completed, is already having a bearing on important coastal resource management decisions. For example, researchers working at the Waquoit Bay NERR, located on

Cape Cod in Massachusetts, were recently awarded a 4-year, $2,000,000 Land Margin Ecosystem Grant to investigate how changes in the landscape mosaic associated with development in the Waquoit Bay watershed affect the delivery of groundwater contaminants to the Bay. One of the key objectives of the project will be to provide a scientific basis for the development of land use controls around the Bay with regard to water quality considerations. An analysis of the Waquoit Bay watershed, which includes five sub-units with different development densities permits researchers to compare groundwater loadings and review the effects on varying dosages in the waters along the shore.

Another example of research directed towards providing urgently needed coastal management information was the seagrass studies conducted at Padilla Bay NERR. Padilla Bay, located in Washington State contains extensive meadows of seagrasses that grow submerged some or all of the time. Research conducted by Western Washington University, University of Washington, Washington State Department of Ecology, and the Washington State Department of Fisheries have demonstrated the importance of seagrasses to juvenile salmon, surf smelt, Pacific herring, and Dungeness crabs. The results of these various studies has provided the necessary back-up information so that Washington State natural resources department is working to preserve the remaining seagrass beds throughout Puget Sound and Washington State. Any proposals for work that destroy existing seagrass beds have been required to be modified, re-sited, or in rare cases, seagrasses replanted to replace the destroyed beds. These actions are helping to preserve the pacific salmon fishery ($80 million annually) and the Dungeness crab fishery ($10 million annually) in Washington State.

Research coordinated by the Apalachicola Reserve in Florida, was instrumental in the establishment of a Greater Apalachicola Bay Management Plan for commercial finfish and shellfish harvesting. Reserve staff also assisted with development of the most comprehensive watershed land-use plan in the state of Florida. Research as other Reserves has also provided insight into the effect of pesticides, toxic metals, and sedimentation on estuarine ecosystems.

Collectively, the Reserves comprise a nation-wide research program that is literally on the "cutting edge" of estuarine science; endeavoring to provide coastal managers with important information about ecological functions and socio-economic values performed by estuaries. Despite the excellent research which is being conducted at Reserve sites, the potential of The National Estuarine Reserve Research System is still largely unfulfilled, in part, because there are presently only 6 Reserves with on-site research laboratory facilities and only 7 Reserves are even able to provide boats and aquatic field sampling gear.

Within the past two years MEMD has recognized that development of an efficient long-term estuarine research program is contingent upon having a good understanding of the natural resources that have made Reserve designation so important and the issues and problems that affect these resources. To meet these needs, MEMD commenced a phased monitoring initiative in 1989. This monitoring program will enable Reserve staff to characterize the resources they are expected to manage. Once this phase is accomplished, information will be synthesized into a compendium of resource issues, management constraints, and research needs. The third phase of the resource monitoring program will "target" the most important resources for development of a data set to document long-term changes in the estuarine environment with respect to natural occurrences and "man induced" changes.

Although there are other nationwide coastal research and monitoring programs within the Federal government (USEPA, various NOAA divisions, USFWS, etc.); the NERRS Program is unique because all of its research and monitoring efforts concentrate on estuarine sites. Other special features include:

.....each designated Reserve is afforded some measure of resource protection, thus ensuring site stability for long-term studies.

.....as a component in the NERRS Program, continuity of funding for monitoring is assured through state-federal matching fund grants.

.....Reserves represent a broad range of estuarine ecotypes, but monitoring activities are coordinated through one agency (NERRS); thus minimizing the possibility of duplication of efforts by individuals and/or agencies.

.....on-site Reserve managers are able to provide facilities, equipment, and logistical support for monitoring projects.

.....the NERRS monitoring program is oriented towards determining trends in relatively undisturbed portions of estuarine ecosystems, and concentrate on natural changes that occur over time, rather than responding to declining environmental conditions after the estuarine environment have been severely impacted by human activities.

The CZMA Reauthorization Act of 1986, as amended, also stipulates that designated Reserves will serve to enhance public awareness and understanding of estuaries and provide suitable opportunities for public education and interpretation. In 1989, National

Estuarine Research Reserves attracted more than 250,000 visitors. Nearly 60,000 of these people took guided interpretive tours provided by Reserve staff, enrolled in educational classes and teacher/leader workshops or participated in school programs for students from kindergarten through college.

Through curricula programs developed by Padilla Bay staff with combined Federal and State funding, over 25,000 students and teachers have received "hands-on" training in estuarine ecology and conservation issues regarding fragile coastal resources. Other Reserve educational efforts made possible through Federal-State matching funds have included the development of educational materials for grade school and middle school students, brochures, posters, and multi-media presentations suitable for use by local school systems.

Reserve staff are active in hosting professional meetings that bring together coastal managers, scientists, planners, and educators. For example, in late 1989, the Old Woman Creek Reserve sponsored a symposium entitled "Priorities for Great Lakes Coastal Wetlands Research." This conference attracted 61 scientists, college educators and researchers, and representatives of government agencies from 11 states and Canada. Proceedings from the conference will be available later this year, and are expected to enhance the exchange of coastal research and management recommendations throughout the Great Lakes region.

Other Reserves are also involved in projects to bridge the gap between research, education, and decision making. Some successful ventures include: "Community Classroom" at Apalachicola Reserve; "Project Outreach" at Rookery Bay; production of an oral cultural and natural history at Waimanu Reserve; and "Coastweeks" activities which have become a regular part of increasing public awareness of estuaries at Reserves throughout the System. Considering that only 8 Reserves presently have on-site visitor centers and classroom facilities, these educational efforts are remarkable.

SUMMARY AND RECOMMENDATIONS

We know of no other System within the Federal-state Partnership Program that has so successfully integrated wetlands protection, scientific research, public education, and recreational opportunities with the coastal decision making process. Through the efforts of the National Estuarine Reserve Research System, made possible by Section 315 of the CZMA, federal and state coastal managers are becoming increasingly aware of the many subtle linkages that exist between the actions they take and the health of our nation's estuarine ecosystems.

Without sufficient understanding of the inner workings of estuaries, we risk making substantial and unwise expenditures of coastal management funds at the Federal, state, and local levels. We also risk the very real mistake of taking management actions, or lack of actions, that may result in serious and long-term damage to our Nation's estuaries. The National Estuarine Reserve Research System is a viable means for providing sensible solutions to these serious concerns through its research, monitoring, and education programs.

Thank you for the opportunity to present testimony pertaining to the NERRS Program and Section 315 of the current version of H.R. 4030, entitled "Coastal Zone Act Reauthorization Amendments of 1990". I am also most appreciative of any considerations given to my remarks by members of this distinguished Subcommittee.

Mr. NOWAK. Thank you very much. We will turn now to—I'm pondering how we decouple the political process.

[Laughter.]

But we'll get back to that a little later. Let's turn to Stephen Bliven.

Mr. BLIVEN. Thank you, Mr. Chairman. My name is Steve Bliven. I am the Assistant Director of the Massachusetts Coastal Zone Management Program. I'm delighted to see the subcommittee's interest in the question of monitoring and have the chance to speak to you today.

My written testimony has been submitted for part of the record. I would like to emphasize, really, four particular—

Mr. NOWAK. I'll just mention, you know, all the testimony will be made a complete part of the record.

Mr. BLIVEN. Thank you.

Mr. NOWAK. So, your formal statements that we have and all other material that you wish to submit will be made a part of the record following your testimony so we can get the continuity.

Mr. BLIVEN. Thank you, sir. In light of that situation, I'd like to really emphasize four points in my discussion. First, that the Coastal Zone Management Act needs to be reauthorized. This coming from a coastal zone manager, it is not a surprising statement. Secondly, on the question of monitoring, monitoring covers a multitude of sins. There are a lot of kinds of monitoring, a point I'll come back to, probably ad nauseam, during this discussion. Thirdly, there is the desperate need for the long-term commitment to monitoring. You've heard that already from several speakers. You'll hear it again, I'm sure. And fourthly, that the monitoring has to be developed to be meaningful in a way that provides results for coastal decision-makers.

First of all, the reauthorization of the CZMA, you have before you currently in the House, H.R. 4030, is something that we strongly support for the Massachusetts coastal program. It defines the Coastal Zone Management Program within the various States, including a small subgroup thereof for the estuarine Research Reserves. Within the estuarine Research Reserves there is a small subgroup set apart for funding of research and monitoring. When you break down the dollars, it turns out the money within the Coastal Zone Management Program works out to be about 2 percent for research and monitoring, when you combine the coastal program administration and management processes and the estuarine Research Reserves. So we're talking, unfortunately, about a fairly small percent of the dollars in the FY 1991 budget, or proposed budget.

In the Massachusetts Coastal Zone Management Program, we are established as part of the Executive Office of Environmental Affairs. That becomes important because it means that the management program is tucked into the same general section of State government as the Water Quality Program, as the Marine Fisheries Program, and as the land-use or at least environmental, recreational, and open-space land-use management programs. That allows us to network, interface—whichever word we're using these days—with a lot of other agencies. It allows us to run, or administer through our office a number of interactions with Federal Gov-

ernment, and as examples thereof we have in Massachusetts one National Estuarine Research Reserve on Cape Cod. We're involved in three of the National Estuary Programs through EPA: Buzzards Bay, the Massachusetts-Cape Cod Bay Complex, and the Narragansett Bay Project. We are unfortunately exporters of some of our process materials to Narragansett Bay, something we're not particularly proud of.

We also are involved in a three State, two Canadian province project, focusing on the Gulf of Maine that, hopefully, will develop a management program for that particular body of water. All of these Federal, State and, to some extent local interactions, tie into research and monitoring. We need to better understand these bodies of waters, these estuaries, embayments, in order to better manage them. The Research Reserves are, perhaps, a classic example of that. By defining generally a fairly small embayment, understanding that, and comparing it with other similar physical or chemical or biologic embayments in the region, we can make some very good management decisions based on the information.

Types of monitoring. We have heard the word "monitoring" used to touch on a lot of different things this morning, and I just want to emphasize that monitoring ranges from such things as public health monitoring, monitoring of shellfish, of fish for public consumption, to monitoring of ecosystem health, to compliance monitoring. They all have very different needs, very different results, and very different uses, and I hope in the subcommittee's deliberations following these hearings that it is very clear which dollars go to where and what kinds of results come from where.

There are some very focused monitoring types for public health. There are some very focused types of monitoring for compliance with licenses, permits and regulations. But the third kind of monitoring of ecosystem health sorts of things—the Status and Trends Program and EMAP—are aimed towards, are much broader and much longer scale in nature. There needs to be a commitment to those sorts of long term programs despite the lack of sexiness of the programs. They take a long time to develop in some cases. They are not necessarily results oriented. They give you an indicator that something is good or something is bad and spin off thereby into additional studies.

Sometimes they give you bad news. We learned shortly before the Presidential campaign last year that Boston Harbor was one of the dirtiest harbors in the Nation, something that was brought home to most of the country during that process. That was not good news to us. It means we have to spend billions of dollars for clean-up. Somehow you don't look happily on monitoring when it tells you things like that.

But there has to be that commitment. It has to be long-term and it has to be with the understanding that sometimes it doesn't tell you exactly what you want to know.

Finally, it needs to be targeted for decision-makers. Some specific examples coming out of the Waquoit Bay National Estuarine Research Reserve, I think, give examples of this. We have been fortunate enough to be able to put together a long term—a land-margin ecosystem research grant. These normally come out of the National Science Foundation. In our case because there was not sufficient

money in NSF, through the help of a number of good offices, we managed to combine efforts from EPA, NOAA, National Science Foundation, the States, the regional planning agency, and some local interests to develop a program that will ultimately spend about $2 million over the course of four years to give us a far better understanding of the kinds of inputs to typical estuaries on Cape Cod and in the rest of the biogeographic zone from development. We are going to get a much better handle on how much actually gets into the water from septic systems, from road run-off, from other phenomenon, and its direct applicability to decision-makers will allow us to make very clear-cut decisions on setbacks from waters' edges, on how many living units you've actually put into a watershed, what kinds of land use we can allow without degrading the body of the water and the resultant shellfish and fisheries.

There is a very strong public education component of that through our Estuarine Advocates Program, whereby citizens are going to be doing some of the rudimentary monitoring generally for things like pH, salinity, water clarity, and so forth, and sort of whether there is something very obviously bad with the system—fish dying, algal blooms, and so forth.

We find that that brings in the interest of the local citizenry who are actually making many of the environmental decisions for zoning and for health things. Secondly, it provides us at least with an earlier warning system where to look further for particular issues. And finally, it begins to provide the support that we think will be necessary for future reviews of these sorts of areas.

I've touched very briefly on the four major points I wanted to stress, and I look forward to your questions. Thank you.

[The prepared statement of Mr. Bliven follows:]

COASTAL ZONE
MANAGEMENT

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
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Testimony of

Stephen R. Bliven,
Assistant Director
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Presented on
26 June 1990

to the
U.S. House of Representatives
Committee on Science, Space and Technology,
Subcommittee on
Natural Resources, Agriculture, Research and Environment

I appreciate the opportunity to appear before the Subcommittee on Natural Resources, Agriculture, Research and Environment. My intent today is to touch on two topics: to support pending bills H.R. 4030 and H.R. 4115 and to address some comments toward the form taken by federal programs of coastal resource monitoring, something marginally addressed in the bills at hand.

Referring to the pending legislation, I would particularly like to draw the Subcommittee's attention to H.R. 4030, the Coastal Zone Management Act Reauthorization Amendments of 1990. Passage of this bill will allow for the continuation of the federal-state partnership in the management of the resources of our nation's coastline; delay in its passage could jeopardize both the jurisdiction and funding of state coastal programs.

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The Coastal Zone Management Act (including Section 315 establishing the National Estuarine Research Reserves — formerly Estuarine Sanctuaries) was first passed in 1972. Since that time, the provisions of this Act have produced Coastal Zone Management Programs in most of the eligible states and the designation of eighteen Research Reserves. Each of the latter is designed to preserve and study estuaries representing specific physical and biological types, and educate present and future coastal decision-makers about these resource areas, thereby resulting in better, more widely accepted and defensible, coastal management efforts.

In Massachusetts, our Coastal Zone Management Program (MCZM) was formally accepted in 1978 and made part of the Executive Office of Environmental Affairs, reporting directly to the cabinet-level position of Secretary of Environmental Affairs. We have used this administrative position to provide coordination for the wide range of state environmental activities that affect our 1500 mile coast, and to "network" a significant number of federal programs into complementary efforts. Some of the latter, developed or presently administered through the MCZM Program, include: one NOAA-designated National Estuarine Research Reserve (Waquoit Bay on Cape Cod), three EPA-designated National Estuary Programs (Buzzards Bay, Massachusetts/Cape Cod Bays, and the upper reaches and tributaries of Narragansett Bay), and a three state - two Canadian Province projects in the Gulf of Maine partially funded by NOAA.

Also, and perhaps more germane to this hearing, these three types of effort reflect the nature of coastal environmental monitoring as it exists now at the federal level, and how at least one state relates to the situation.

As the Subcommittee is undoubtedly aware, monitoring comes in a variety of forms and purposes. They all, however, share some common threads. By and large, they are not results-oriented research programs designed to solve a particular problem. Instead they are intended to define the status of an ecosystem, or at least a segment of that system, and follow its trends or changes. To do that, monitoring programs must be in place and functioning over extended periods of time, often decades, in order to overcome short term fluctuations in environmental parameters. And they can be expensive. All of these features tend to make monitoring programs difficult to fund through the political process. To be effective they must outlive administrations, budget cycles, and economic fluctuations. Their results are slow in coming, and often indicate problems without ready solutions; in fact they often call out for additional, more focused studies at even higher costs. No wonder they are not politically popular — they are expensive, don't produce "sexy" results, and regularly bring bad news. But, if we are to understand the nature of the coast and its resources, and our impact on them, there must be valid, long-term monitoring efforts in place.

In developing any monitoring program, major choices must be made. There will never be enough money to monitor every parameter of an ecosystem, and even if there was, there would not be enough time to process all of the data. Unfortunately, neither is there one single aspect or location that can be used to characterize an ecosystem. Therefore, monitoring programs must generally decide whether to sample limited features of a wide range of sites or a wide range of features at a limited number of sites. Both can provide valid results and may be of great use but their limits must clearly be recognized.

This variation in design is readily seen in existing federal monitoring efforts.

Until recently, most monitoring of coastal resources at the federal level was directed towards public health concerns ("Is it safe to swim in the Bay?" "Will eating shellfish make me sick?") or wildlife population dynamics ("How are the striped bass doing?" "Are there enough fish stocks to maintain the fishery?"). Environmental or ecosystem health, its status and trends, was generally left to academic review, often with little attention to management implications. Design and protocol of monitoring activities often varied depending on the researcher and his or her focus. Coastal resource managers regularly complained about the long delay in applying results of such work to real world decisions, and to the difficulty of comparison between data sets sampled or tested with different techniques. Consequently, at various times, responding to various stimuli, the federal government attempted to establish ecosystem monitoring programs.

The National Estuarine Reserve Research System is an example of the "limited site, extensive monitoring" concept. Creation of the National Estuarine Research Reserve Program established capability for comprehensive monitoring of specific estuaries and their watersheds "typical" of their bio-geographic zone for a wide array of parameters. Individual states joined financially and administratively with the federal government to acquire and develop the Reserves; the states further commit to their operation over the long run. We are firmly convinced that upon full implementation of the Estuarine Reserve System, timely and important data will be routinely made available to local,

state and federal decision-makers managing the coast. Most sites designated to this point intend to have on-site laboratories and staff dedicated to rapid testing, management of data, and dissemination of results. Having such on-site facilities reflects a commitment to a long-term program of monitoring changes in the estuary and its resources. The NOAA Office of Ocean and Coastal Resource Management, Marine and Estuarine Management Division provides coordination for the use of common sampling and testing protocols and "advertises" the availability of the data. Due to relatively low levels of funding provided to this program in the past, and relatively high acquisition and capital development costs, many of the designated sites are only now beginning to implement monitoring programs. Some, such as the Old Woman Creek site in Ohio, built a strong program despite limited funds and are well ahead of the rest. During the past administration, minimal coordination between the NOAA Coastal Management Programs and other estuarine programs within NOAA and other federal agencies further hampered the effectiveness of the Research Reserves as monitoring sites. This may be noted in the fact that few of the Reserves are included in the NOAA Status and Trends Program. Over the past several months, however, more encouraging signs are coming out of the current administration and we in the state program wait hopefully for greater coordination and cooperation.

The NOAA-operated National Situs and Trends Program is based on testing of limited parameters over a wide range of sites. Constrained by available funds, this program chose to test environmental integrators -- sediments and organisms -- rather than the more dynamic features such as water quality. Because sediments and sessile, bottom-dwelling organisms, take up contaminants

slowly and release them slowly, they provide a good indication of the health of an ecosystem over time. It further means that valid results may be gathered by sampling less frequently. Such indicators, however, generally do not react rapidly to sudden changes in their environment.

The EPA-administered National Estuary Programs and Environmental Monitoring and Assessment Program take a different approach. To this point they have focused on the more dynamic features of the ecosystem -- water quality. Water quality tends to be less homogeneous over both time and space and consequently requires more intensive sampling. Given budgetary limits, this means a "heavily sampled, smaller area" process. An advantage is that this form quickly notes significant changes in environmental parameters.

While all of these monitoring designs are valid, none has been in existence long enough, or funded sufficiently, for the state coastal programs to be able to use their results. From our perspective, in the past we have seen agencies going in different directions, often without apparent knowledge of or cooperation with other entities. Competition for limited federal dollars being spent on monitoring has led in some instances to a defensive posture, more protective of a particular program than cooperation in design and results. It has also led to a patchwork approach within the states. In Massachusetts, we have used the EPA's National Estuarine program and NOAA's Coastal Zone Management Section 309 (interstate) program to develop a design for a state coastal resources monitoring program (plan development is still in progress). We have used the limited number of Status and Trends sites as indicators of whether additional, complementary or supplementary

investigations are needed in specific areas. And we are using the Waquoit Bay Estuarine Research Reserve as a field laboratory to focus on specific aspects of one watershed. This patchwork approach means that we must spend considerable amounts of time integrating differing conceptual schemes, administrative details and timetables, and respond to several different grant masters.

The need for maximizing the use of each federal dollar spent in monitoring efforts is clear. We have noted with pleasure the increasing efforts at communication between the EPA and NOAA programs and urge that they continue, but we have a certain amount of apprehension that changes in the political or economic environment could slow or reverse this process. From the perspective of a state coastal manager, there are several possible steps that could be taken that would lead to better monitoring programs, and more meaningful results. These include:

- Congress should commit to fully funded, long-term monitoring;
- Congress should recognize that different designs, while equally valid, may produce different results requiring further work to correlate;
- Congress should commit to existing programs and provide them with an appropriate level of funding to accomplish their allotted mission before developing new programs which may merely serve to dilute available financial and administrative resources;
- Congress should strongly encourage cooperation and coordination between various monitoring programs in design, sampling, and data management activities, but not necessarily push for combination of

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programs;

- Congress should push for more widely available results of monitoring programs.

I thank you for the opportunity to discuss these matters with you, and for your interest in coastal management in general. If I may be of any further service to the Subcommittee, please contact me immediately.

Mr. NOWAK. Thank you very much. Dr. Mooers.

Dr. MOOERS. Thank you, Mr. Chairman. I appreciate this opportunity to provide comments on two topics: one, the national programs associated with the coastal ocean, and (here I use "coastal ocean" in the following fashion and to include the exclusive economic zone, estuaries and the Great Lakes) and the second major topic is that of a needed national policy and program for satellite remote sensing of the ocean.

I am a physical oceanographer. I am a professor with the Institute for the Study of Earth, Oceans, and Space at the University of New Hampshire. So I think my role here is to provide a context both in terms of a somewhat larger scale than my esteemed scientific colleagues here and longer term, and to provide some perspective from the physical aspects of these important issues.

In the arena of coastal ocean understanding and management, in recent decades we have made a lot of progress in beginning to understand the coastal ocean ecosystems, and a lot of that has depended upon the use of new technologies for observing the coastal ocean and the use of numerical models and supercomputers.

Satellite ocean remote sensing is especially useful for establishing spatial patterns and the connectivity in the coastal ocean. Such information makes obvious the regional systemic aspects of environmental phenomena which provide a critical perspective for designing approaches to environmental management that reach beyond point source monitoring.

Often in the scientific community, we—most researchers—are suspicious of monitoring activities. However, that is because we haven't been strongly enough involved in them ourselves, and if they are carried out well, the resultant time series or maps can prove to be absolutely invaluable for studying coastal ocean and climatic changes or even for process studies, and one of our concerns is to establish monitoring systems which can define the background natural variability, and therefore, to be in a position to detect unambiguously changes due to anthropogenic causes in the presence of such natural variability. It is not easy in the coastal ocean and requires a campaign of long-term observations to define the average variability and its nature.

Another of our concerns is that monitoring efforts be certain to include the appropriate physics as well as appropriate ecology and chemistry. The connection between physics and ecology and fisheries and so forth is often a bit subtle for the layman.

One of the more dramatic cases in point is the association of fisheries with oceanic fronts. Oceanic fronts are much like atmospheric fronts that we are all familiar with in our day-to-day existence, and these are zones of the ocean where there are strong temperature changes due to the convergence of horizontal flows. Those convergences concentrate plankton, which attract fish for food, and these fronts in the ocean occur on a broad range of scales. Those which are at least a few kilometers in size can be detected in satellite infrared imagery. Thus, knowing where the fronts are located can help fisheries scientists as well as fishermen to zoom in on where the fish are likely to be concentrated.

This strategy has been used in a number of cases by NOAA scientists to discover new fisheries for tuna, for example, in the South

Pacific, based upon their North Pacific experience with such images. It has been—is being used now by NOAA fisheries scientists off the southeast coast in the Coast Watch program to examine the effects of Gulf Stream shingles on the transport from the Gulf of Mexico of toxic algae into the shelf waters of North Carolina. They have also been used by NOAA scientists in the Gulf of Mexico to help manage the fisheries in the coastal ocean there and to discover new fisheries as well.

As there is a concern in the scientific community with monitoring activities, environmental managers also have their share of frustrations. From my conversations with them, they cannot deal directly with the huge volume of numbers accumulated by typical contemporary monitoring activities.

There are a number of solutions. One of them is to use numerical models to make whole field estimates so that the results can be represented as maps, and the other is to use—make a management use of computer graphics, especially color video, as part of an effort to provide the benefits of computer-driven visualization and animation to the environmental manager.

The Federal Government, in particular, has developed numerous programs in over 10 agencies to cover aspects of basic and applied research, applications, operations, and management in the coastal ocean. This pluralistic approach has led to a rich variety of activities dealing with coastal ocean understanding and management.

While there is certainly a compelling need for national standards and coordination, many of the technical and management issues can best be addressed at the regional level where the specialized expertise often resides and where accountability and responsiveness to local needs can be best achieved.

Collaboration between the public, academic, and commercial sectors, all playing unique, though constructively overlapping roles, is also essential to energize and involve the available knowledge.

The proposed National Estuarine Research Reserve System is organized around the regional management of designated estuaries and casts research and public education in central roles. The research results are anticipated to guide the management of the estuaries in a fashion that a better educated public can appreciate. Hence, the proposed program of the National Estuarine and Research Reserve System, from my perspective, is a sensible approach to meeting some of the needs outlined above. However, a broader, more regional approach is required to manage and protect the full coastal ocean.

There is a role for the Committee on Earth Sciences or an equivalent entity to examine the needs and options in such a regional multi-agency, multi-sector approach to national needs in the coastal ocean. With modern knowledge, technology, and methodology, there is an opportunity to form the ocean equivalent of the National Weather Service to predict conditions for the coastal ocean relevant to coastal ocean management. It would be wise for such ocean prediction activity to be linked to the regional approach espoused above.

Let me turn now to the second topic, satellite ocean remote sensing, and though satellite remote sensing of the ocean is in its infan-

cy, it has already proven to be a very powerful means to obtain an enormous amount of information about the ocean on a global basis.

The ocean sensors, though, have typically been flown on missions for only a few months or years in duration. None are in space at the moment. For coastal ocean research, monitoring, and management, there remains an urgent need for an ocean color scanner to be maintained in space on a continuing basis. The Europeans and Japanese will be moving ahead with missions soon. We also have hopes for the future of U.S. ocean satellite missions such as TOPEX, SeaWIFS, and EOS.

The present situation of slipping and even cancelled U.S. ocean satellite missions is entirely unsatisfactory, especially when these existing satellite remote sensing technologies could enable the acquisition of invaluable information for addressing critical issues associated with global change and coastal ocean management, especially if pursued in a deliberate, sustained fashion.

While satellite remote sensing is not a panacea, it is unique in its power, but it is most effective when it is combined with other ocean observing systems that sample from within the ocean. It is even more effective when it is combined with numerical models to have a basis to make comprehensive estimates throughout the entire ocean volume.

Overall, it is this aggregate of direct and remote sensing, surface and subsurface observation, numerical models, and associated computer and communications technologies which will provide a considerable technical basis for optimism about being able to deal eventually with the serious societal issues raised by coastal ocean management needs and global climate change concerns.

I think the present sorry state of ocean satellite remote sensing in this country is due to several factors. One of them is that there is a lack of appreciation that there are both research and operational aspects to satellite remote sensing of the ocean. Second, unlike the meteorological community, the oceanographic community does not have a strong operational component committed to delivering high-quality information products on a timely basis to meet society's needs—societal needs which would create an enormous demand for satellite data. Third, there is a lack of an overarching national policy and program which accommodates the several interests and exploits the several opportunities noted above.

It is likely that there is going to be a push for an international effort in monitoring and managing the global and coastal oceans early in the next century and that we will likely see on the international scale a push for global satellite ocean remote sensing systems both for global climate change and coastal ocean management purposes much like the meteorological community has created, and, in my opinion, the U.S. should take a leading role in such an international campaign. Already NASA has developed cooperative satellite programs with the French and Japanese. This might provide a basis for further international endeavors. That is one way to help spread the cost burden.

Finally, I strongly endorse the proposal for the Committee on Earth Sciences, together with representatives from the academic and commercial sectors, to undertake an assessment of present inadequacies in satellite ocean remote sensing capabilities nationally

and of major goals for ocean science, and to make recommendations for improving capabilities and achieving goals.

It may be only through such a strategic planning process that we can avoid in the future gaps like the 15-year hiatus which will have occurred between civil sector ocean satellite missions—that is, between SeaSAT and TOPEX—while our overseas cohorts move ahead based largely upon our earlier initiatives and successes.

Thank you.

[The prepared statement of Dr. Mooers follows:]

Statement of Professor Christopher N. K. Mooers
Institute for the Study of Earth, Oceans and Space
University of New Hampshire

before the
Subcommittee on Natural Resources, Agricultural Research, and Environment
of the
House Science, Space, and Technology Committee

26 June 1990 (REVISED)

Mister Chairman, I appreciate this opportunity to provide comments on (1) the national programs associated with the coastal ocean, including the role of satellite remote sensing in such matters, and (2) a needed national policy and program for satellite remote sensing of the ocean. (NOTE: The term "coastal ocean" means here the EEZ, estuaries, and the Great Lakes.) I am submitting this statement as a concerned physical oceanographer with over twenty years of professional experience in several academic institutions on three of our coasts and with expertise in coastal oceanography, mesoscale ocean prediction science, and Naval Oceanography. Recently, I have chaired, under sponsorship from nine federal agencies and the Ocean Studies Board/NAS, a preliminary planning effort for the Coastal Ocean Prediction Systems(COPS) Program. Participants included scientists, engineers, and managers from industry and the agencies as well as academia. An approach to an operational coastal ocean prediction system was outlined and documented in the COPS Planning Workshop Report(1990).

COASTAL OCEAN UNDERSTANDING AND MANAGEMENT

In recent decades, the scientific research community has begun to make substantial progress in understanding the coastal ocean as a combined physical, chemical, and biological system. This progress has been due to several factors: the natural advance of science, the growth and development of the involved scientific community, the expansion and development of appropriate academic and research institutions, the introduction of new ocean observing technologies, and the development and exploitation of numerical models on supercomputers. The new sampling technologies incorporate electronic sensing systems, computer-driven data acquisition systems, and remote sensing systems. The remote sensing systems include acoustic and electromagnetic sensors used from ships, aircraft, or satellites.

Satellite ocean remote sensing is especially useful for establishing spatial patterns and connectivity in the coastal ocean. Such information makes obvious the regional, systemic aspects of environmental phenomena, which provide a critical perspective for designing approaches to environmental management that reach beyond point source monitoring.

In parallel, the increasing population, urbanization, and industrialization of the coastal zone have led to many conflicting uses, and to environmental degradation in numerous cases. The several levels of government have attempted various kinds of responses, ranging from increased research to regulation. As part of this expanded concern for coastal ocean management, an interest in expanded coastal environmental monitoring, or coastal ocean monitoring, has developed.

Monitoring is not a well defined concept. It starts with the notion of making measurements, generally on a sustained and indefinite basis. Thus, there is an aura of the regular or routine about monitoring which can quickly earn it the label of "mindless monitoring" from scientific critics. Beyond making technically valid measurements of a particular variable, there are several questions which must be answered to qualify the activity as "mindful monitoring". For example, which variables must be measured? why? how often in space and time? how accurately? what will be done with the data? has the monitoring strategy been designed with a long-term, preventative, and systems perspective or is it narrowly focused on documenting short-term, acute environmental degradation? Related issues concern whether or not the knowledge of processes is adequate to design a smart sampling strategy, whether or not models are used adroitly to interpolate and extrapolate the ineveitably sparse data in space and time, whether the monitoring results will be widely available and subjected to the purgative powers of peer review, and whether analysis efforts will be funded to place the results in a broad context of process understanding, coastal ocean circulation system analysis, or ecosystem analysis. In other words, will the monitoring endeavour be scientifically credible? Though scientists are often suspicious of monitoring activities, if they are carried out well, the resultant time series or maps can prove absolutely invaluable for studying coastal ocean climatic changes or even for process studies. One of our concerns is to establish monitoring systems which can define background natural variability and detect unambiguously changes due to anthropogenic causes in the presence of such natural variability. This concern is the classic "signal-to-noise ratio" problem which can be very serious in the coastal ocean. It requires a campaign of long term observations to define the average variability and its nature.

Another one of our concerns is that monitoring efforts be certain to include the appropriate physics as well as the appropriate ecology and chemistry. Physical transports, both vertical and horizontal, have dominant influence on the distribution and evolution of chemical and biological processes and concentrations. By their very nature, they provide space-time connectivity which can be used as part of a smart monitoring strategy if the relationships are well understood.

A case in point is that of fisheries and oceanic fronts, which are commonly where the ocean temperature changes sharply in the horizontal plane in association with strong convergences of flows. These convergences serve to concentrate plankton at oceanic fronts. Fish are attracted to such concentrations of food. Oceanic fronts occur on a broad range of scales. Those which are at least a few kiliometers wide and at least several kilometers long and are manifested by a surface temperature jump, can be detected in satellite infrared imagery. Thus, knowing where the fronts are located can help fisheries scientists as well as fishermen to "zoom-in" on where the fish are likely to be concentrated. This strategy is most effective if the relationships between various fish species and various classes of fronts have already been established by direct studies in the region of interest. However, NOAA scientists have even achieved predictive value from the use of such images in the South Pacific to discover commercially valuable tuna fisheries based on their North Pacific experience. There are other examples of where NOAA fisheries scientists have used satellite infrared remote sensing; one of the most recent examples is the Coast Watch program in the South Atlantic Bight where the effects of Gulf Stream "shingles" on the transport from the Gulf of Mexico of toxic algae into shelf waters off North Carolina are under examination. Another example is the use of satellite infrared images by NOAA scientists to help manage fisheries associated with oceanic fronts in the coastal ocean of the Gulf of Mexico, and to discover new fisheries there, too. However, there is much more room for exploitation of satellite remote sensing to aid fisheries studies and management.

Another case in point is provided by the Summer of 1976 New Jersey Fishkill or Anoxia Event. If there had only been routine monitoring in progress, the initial public belief that the New York City sewage sludge disposal activity on the continental shelf was fully responsible may have been sustained. However, fortuitously NOAA was just "wrapping-up" a multiyear, applied research project (The New York Bight Project of the MESA Program) on the continental shelf off New Jersey and New York. Hence, they had an extensive observation system in place with physical, chemical, and biological sensors and were able to document the unusual seasonal evolution that year: winter storms ended earlier than usual, yielding earlier, shallower, and

stronger thermal stratification over the continental shelf; in turn, this yielded an intense phytoplankton bloom, the detritus from which contributed to the depletion of dissolved oxygen in the lower layer, which in turn led to fish mortalities. The researchers had developed a model that was run in a diagnostic mode to sort out the cause-and-effect relationships, which pointed to natural variability as being the most likely cause of the fishkill and anoxia event. The model also elucidated the role of the anomalously persistent northeastward winds that summer which contributed to an onshore flux of nutrient rich waters in the lower layer, and which then further compounded the event by supporting more plankton growth. If the data had been available to a numerical model running in real-time, as could be done today, the developing event could have been analyzed, and possibly even forecast, so that timely action could have been taken by fishermen to catch the fish before they suffocated.

As there is a concern in the scientific community with monitoring activities, the environmental managers also have their share of frustrations. They can not deal directly with the huge volume of numbers accumulated by typical contemporary monitoring activities. One solution to this dilemma is to use numerical models to make whole field estimates which can be represented as maps. Other variables might be best handled in a time series fashion. Another solution rests with the imaginative use of computer graphics, especially color video, as part of an effort to provide the benefits of computer-driven visualization and animation to the environmental manager.

For example, we forsee the possibility of providing environmental managers with computer-driven graphical products depicting the evolving circulation, sea level , and temperature and salinity structure in an estuary or continental shelf region of interest. Such products would be based upon telemetered observations and numerical models run on supercomputers, which had been carefully developed and tested. The environmental manager would have available to him or her the capability of visualizing the evolving ocean environment much as a traveler can now envision the weather he is likely to encounter before setting out on a cross-country flight by viewing the weather channel on his TV screen. This information could help an environmental manager deal more effectively with many environmental events; e.g., an oil spill trajectory or a man overboard from capsized sailing boat.

The federal government in particular has developed numerous programs in over ten agencies to cover aspects of basic and applied research, applications, operations, and management in the coastal ocean. This pluralistic approach has led to a rich variety of activities dealing with coastal

ocean understanding and management. Such a wideband approach might be called "exploratory management", which may be appropriate when no one agency has a great answer on how to proceed. One downside of such independent behaviour is that there are innumerable lost opportunities. When one agency's narrowly conceived role blinds it from seeing national value in another agency's accomplishments, the nation loses. Another downside is that research and applications or operations can be thought to be disconnected to the extent that a mission-oriented agency does not utilize research results well and, consequently, performs inefficiently or even ineffectively. Hence, there is no doubt that a higher level of coordination, or at least communication and collaboration, is needed between agencies and academia.

One way to view the coastal ocean and its management is to recognize its regional character. While every coastal ocean region is forced by winds, tides, and river runoff, these forcings vary in absolute intensity, character, and relative importance from region-to region. Other differences are associated with latitudinal effects on climate and ecosystems, variations in the width of the continental shelf, the relative prevalence of submarine canyons, and so forth. While there is certainly a compelling need for national standards and coordination, many of the technical and management issues can best be addressed at the regional level where the specialized expertise often resides, and where accountability and responsivenees to local needs can be best achieved.

There is so much to be done in managing and understanding the coastal ocean that it will require the collaboration of the several agencies, and the state and local governments, involved. Collaboration between the public, academic, and commercial sectors, all playing unique, though constructively overlapping, roles is also essential to energize and involve the available talent and knowledge.

The proposed national estuarine research reserve system is organized around the regional management of designated estuaries. It casts research and public education in central roles. The research results are anticipated to guide the management of the estuaries in a fashion that a better educated public can appreciate.

Hence, the proposed program of a national estuarine research reserve system is a sensible approach to meeting some of the needs outlined above. However, a broader, more regional approach is required to manage and predict the full coastal ocean. There is a role for the Committee on Earth Sciences, or an equivalent entity, to examine the needs and options in such a

regional, multi-agency, multi-sector approach to national needs in the coastal ocean. With modern knowledge, technology, and methodology, there is an opportunity to form the ocean equivalent of the National Weather Service to predict conditions for the coastal ocean relevant to coastal ocean management; it would be wise for such ocean prediction activity to be linked to the regional approach espoused above.

SATELLITE OCEAN REMOTE SENSING

Though it is only in its infancy, satellite remote sensing has already proven to be a powerful approach to observing the coastal as well as the global ocean. The sensors used to date include the radar altimeter for ocean currents, the radar scatterometer for ocean surface winds, the synthetic aperture radar for surface waves and other small scale, sea surface physical phenomena, and the so-called ocean color scanner for coastal turbidity and, thus, suspended sediments, and for color pigment estimates of chlorophyll and, thus, primary productivity, i.e., the growth of phytoplankton populatons. These sensors have typically been flown on missions for only a few months or years in duration. None are in space at the moment. For coastal ocean research, monitoring, and management, there remains an urgent need for an ocean color scanner to be maintained in space on a continuing basis. The Europeans and Japanese will be moving ahead with missions soon; we also have hopes for future U.S. ocean satellite missions(e.g., TOPEX, SeaWIFS, EOS). The present situation of slipping, and even cancelled, U.S. ocean satellite missions is entirely unsatisfactory, especially when these existing satellite remote sensing technologies could enable acquisition of invaluable information for addressing critical issues associated with global climate change and coastal ocean management, especially if pursued in a deliberate, sustained fashion.

(Ironically, the operational satellite meteorologists of NOAA have provided infrared imagery for many years on a continuing basis for their purposes of determining cloud-top temperatures; as a by-product, it has been possible to determine sea surface temperature to respectable accuracy and extraordinary spatial resolution where and when the absence of cloud cover permits clear-viewing of the sea surface. This sea surface temperature information has proven to be invaluable for revealing patterns of ocean variablility; e.g., those associated with the meandering Gulf Stream and the

eddies it sheds. Though it is only proxy data for the more direct and fundamental information needed in the long term, this is often the only information available to oceanographers on such important and highly variable phenomena.)

Though satellite remote sensing methodology provides a unique and powerful set of techniques for observing the ocean, it is not a panacea because, for one reason, it can only sample surface manifestations of ocean variability. (Fortunately, many processes internal to the ocean have surface expressions. The degree to which subsurface phenomena can be inferred from surface information alone is a continuing research topic.) It is most effective when used as a component of an ocean observing system, which may include airborne remote sensing, especially in the coastal ocean, and in situ sensing systems; e.g., moored and drifting buoys equipped with electronic sensors and satellite telemetry systems, which observe subsurface variability directly. (Ocean acoustic remote sensing is another remote sensing technology, but one which is internal to the ocean, and which is developing rapidly and may have an impact on oceanography analogous to that of radar on meteorology.) Satellite remote sensing is even more effective when combined with numerical models to yield comprehensive estimates throughout the ocean volume. Overall, it is this aggregate of direct and remote sensing, surface and subsurface observation, numerical models, and associated computer and communications technologies which provide a considerable technical basis for optimism about being able to deal eventually with the serious societal issues raised by coastal ocean management needs and global climate change concerns.

Satellite ocean remote sensing is in its present plight in the U.S., in my opinion, due to several factors. One, there is a lack of appreciation that there are both research and operational aspects to satellite remote sensing , and there are civil and defense aspects in each of these areas, too; all of which have common elements. Second, unlike the meteorological community, the oceanographic community does not have a strong operational component committed to delivering high-quality information products on a timely basis to meet societal needs, which would create an enormous demand for satellite data. Third, there is a lack of an over-arching national policy and program which accomodates the several interests, and exploits the several opportunities, noted above. In the absence of such guidance and focused-effort, territorial issues between NASA, NOAA, and DOD are likely to block effective, long-term progress. I also think such a policy and program must be coupled to a commitment to develop operational oceanography, and at the same time the needs of global ocean climate change and coastal ocean researchers must be met.

As we begin to develop a better rationalized and coordinated national effort in satellite ocean remote sensing, we must take into account the growing international activity in global and coastal ocean research, operations, and management. There is a very real possibility that the international community will recognize the necessity of monitoring and managing the global and coastal oceans early in the next century. In addition to numerical models and so forth, the essential ingredient will be a global ocean observing system, with coastal extensions. Hence, among other coordinated efforts, we should as a matter of fact anticipate initiatives to create a global satellite ocean remote sensing system, with close analogies to what the international satellite meteorology community has created. In my opinion, the U.S. should plan to take a leading role in such an international campaign. As a matter of fact, NASA has developed cooperative satellite ocean remote sensing missions in the research mode for the near future with the French and Japanese which may provide a basis for futher development of a truly global, operational ocean remote sensing system.

Hence, I strongly endorse the proposal for the Committee on Earth Sciences, together with reperesentatives from the academic and commercial sectors, to undertake an assessment of present inadequacies in satellite ocean remote sensing capabilities nationally and of major goals for ocean science, and to make recommendations for improving capabilities and achieving goals. It may only be through such a strategic planning process that we can avoid in the future gaps like the fifteen-year hiatus which will have occurred between civil sector ocean satellite missions (i.e., SeaSAT and TOPEX), while our overseas cohorts move ahead based laregly upon our earlier initiatives and successes.

Mr. NOWAK. Thank you very much, Doctor.

We will now turn to Al Beck, the manager of Narragansett Bay National Estuarine Research Reserve, Prudence Island, Rhode Island.

Mr. Beck.

Mr. BECK. Thank you, Mr. Chairman. I appreciate this opportunity to be here.

I also have submitted testimony, as you mentioned, that is part of the record.

Mr. NOWAK. It will be incorporated in the record.

Mr. BECK. So rather than continue with that, I would like to make several points, especially in light of some of the discussion that we have already heard.

First, to give you some understanding of my own personal perspective, my duty station is in the middle of the estuary, and I interact with users and managers of the estuary on a daily basis. I am in the unique position, perhaps, of having been associated with both the National Estuary Program of the EPA and also the NOAA Research Reserve System program.

Presently, I am the manager of the Narragansett Bay Estuarine Research Reserve, and for three years I served as the EPA Office of Research and Development principal representative to the National Estuary Program.

Some of the comments I would like to make—first of all, when it comes to marine monitoring, no one size fits all, and I would like to point out that we have really heard about a hierarchy of monitoring programs here today. This morning, we heard about the national scale efforts, EMAP and National Status and Trends Programs. We also have heard about the NERRS programs themselves, which are primarily on-site monitoring programs to properly manage and understand the resources of the reserves themselves. There is another scale that we need to mention, and this is more on the system-wide or estuary-wide basis.

Each one of those has its own mission and purpose and scale, and while no one can completely substitute for another, there are common elements among them, and I think what we should be striving for is to allow each of these hierarchical programs to meet their needs and try to make the linkages that are appropriate.

With that in mind, I would like to make a couple of comments about the NERRS phased monitoring program. Since I didn't design it, I can say that, in my opinion, it is well conceived and, I think, deals very nicely with the on-site resources, and I think that a new direction in this is evolving, and that is recognizing that the reserves are in a very unique position both institutionally and, in some cases, geographically to be the focus and the site for these long-term data monitoring stations.

We need to generate these long-term, or greater than 10-year, data sets, because, in my experience, it is these data sets that provide the managers with the more compelling information that identifies the status and trends and what is changing. It helps you to understand the natural variability against which you have to judge man's impact on the system. I am strongly supporting these long-term efforts, and I believe that the reserves are in a good institu-

tional and programmatic standpoint to deal with that. But it can't exist in and of itself.

I would like to go on by giving an example of how a National Estuary Program and the Reserve programs come together in Narrangasett Bay. The estuary-wide monitoring plan is being developed under the Narragansett Bay Project, and, incidentally, from a functional standpoint, both the Narragansett Bay Project and the Narragansett Bay National Estuarine Research Reserve are in the same office of the State of Rhode Island Department of Environmental Management. That helps with a little bit of integration and cooperation.

But to go back to now the example of how the estuary program and the reserves can fit together in a cooperative effort, the Narragansett Bay Project has issued a contract to the University of Rhode Island to develop the framework for a bay-wide monitoring program. They have put together a steering committee to help the university scientists, and the reserve is represented on that steering committee, as are State managers from various agencies, other academic people, and others who have been involved in the monitoring efforts over the years on Narragansett Bay.

What it is going to take is for someone to be in charge, because at the present time there are 70 separate monitoring projects taking place on Narragansett Bay. Very few of those projects either know what the other is doing or share data. I think perhaps the presence of a National Estuary Program study in Narragansett Bay gives us the opportunity for having the bay-wide framework and for then finding a way for entities like the Reserve to fit in a reasonable way within this, and what it is going to take—although one is in charge, it is going to take a partnership, and this partnership is going to include not just Federal agencies but the State agencies, the academics, and citizens groups. I think, in my estimation, the citizens groups are going to provide a very effective, a very cost-effective element in long-term monitoring, and they need to be provided with the equipment and the training and the purpose for doing their work.

We have had such a group in operation at the reserve, monitoring a weather tower, since September of 1988, and they handle such sophisticated tasks as downloading a data logger with a laptop computer. We have also gathered wet precipitation samples for chemical analysis, and just a week ago we helped erect—two scientists and five volunteers—erect a 30-foot weather tower. We are also just moving into stream monitoring to measure the flow in streams as part of an overall study by University of Rhode Island scientists to determine the available water on the island for drinking water purposes. We hope shortly to expand this group, Prudence Conservancy, into water quality monitoring as well, which will directly benefit the Reserve and the Narragansett Bay project.

I think that is basically the points that I would like to make, that we need to look at a long-term kind of monitoring for management purposes, that these developing partnerships and cooperative efforts provide the key, and we need to recognize the hierarchy of monitoring efforts as well. And, hopefully, I have been brief enough to provide sufficient time for questions.

Thank you.

[The prepared statement of Mr. Beck follows:]

REPORT TO U.S. CONGRESS

THE HOUSE OF REPRESENTATIVES

SCIENCE, SPACE AND TECHNOLOGY COMMITTEE

SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH AND ENVIRONMENT

CONCERNING TESTIMONY ON

NOAA's NATIONAL ESTUARINE RESERVE RESEARCH SYSTEM

AND MARINE MONITORING

ALLAN D. BECK, P.E.

JUNE 26, 1990

STATEMENT OF
ALLAN D. BECK

BEFORE THE
U.S. CONGRESS
U.S. HOUSE OF REPRESENTATIVES
SCIENCE, SPACE AND TECHNOLOGY COMMITTEE
SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH AND ENVIRONMENT

WASHINGTON, DISTRICT OF COLUMBIA
JUNE 26, 1990

Good morning. I am Allan D. Beck, Manager of Narragansett Bay National Estuarine Research Reserve (NBNERR). From 1986 through 1989, I was ORD's representative to the National Estuary and provided scientific and technical assistance to the Office of Marine and Estuarine Protection and EPA Regional Offices responsible for overseeing individual estuary projects.

Since 1989, I have been on an Inter-Governmental Personnel Appointment (IPA) to the State of Rhode Island, Department of Environmental Management. My position is Manager of the Narragansett Bay National Estuarine Research Reserve (NBNERR) comprised of 2600 acres of land and water on North Prudence Island, Patience Island and Hope Island. The Reserve is one of 18 in the National Estuarine Reserve Research System (NEERS) created under the Coastal Zone Management Act of 1972. The System is a 50-50 partnership between NOAA's Office of Coastal Resource Management, Marine and Estuarine Management Division and the individual states where the Reserves are located. The Reserve sites are selected to preserve representative, ecologically important estuarine areas in each of the coastal biogeographic provinces.

The overall mission of NERRS is the preservation and management of these unique and valuable coastal resources. To achieve this, four specific programs are conducted at the Reserves:

- Resource Management
- Research
- Monitoring
- Education

While each program is a distinct, there is a strong interrelationship between program elements.

With this brief general introduction, I would like to focus on the NERRS monitoring program and then the interaction with other monitoring activities including the EPA National Estuary Program-Narragansett Bay

Project. I believe others will discuss larger scale monitoring programs such as the NOAA National Status and Trends program (NS&T) and EPA Environmental Monitoring and Assessment Program (EMAP) - Near Coastal Component.

The NOAA Marine and Estuarine Management Division (MEMD) NERRS Phased Monitoring Program is a relatively recent initiative and is an adjunct to effective resource management. The overall goal is to help all Reserves establish on-site resource monitoring programs which include at least some elements comparable throughout the national system.

There are three distinct phases:

Phase I: "Environment characterizations" will help Reserve management to gain a better understanding of the resources that they are expected to manage. This includes descriptions of the hydrology, geology, water chemistry/quality, biological resources, the problems and issues confronting the reserve environment, etc. Depending on the site, this approach may require literature research, field research, or a combination of the two. The major question posed by this phase is,"why is it necessary to know more about these resources and how will this information improve reserve resource management?"

Once these studies have been completed and the information has been published, the next phase can be entered.

Phase II: "Site Profile" is a synthesis of information gathered during Phase I that provides an overall picture of the reserve in terms of its resources, issues, management constraints, and research needs. These profiles should also contain a high quality map of the reserve and be in a format similar to the Estuarine Profiles published by the U.S. Fish and Wildlife Service.

Phase III: "Resource Monitoring Program Initiation" can begin only after the reserve has completed the first two phases. The first two stages will help reserve management to pinpoint the most important resources to be monitored and address the scientific aspects of monitoring (what is the scientific basis for the monitoring effort and what are the hypotheses to be tested?). It is important to note that monitoring programs are not meant to monitor all resources at a given site, rather they are meant to monitor those parameters that are deemed essential to providing information necessary to make the "best and most informed" management decisions.

The object is to conduct a well-designed monitoring program that will provide long-term data sets to document the history of change within important resource populations, evaluate the significance of natural and human-induced perturbations on the ecosystem, and visualize and formulate effective resource management policies.

Three main elements crucial to achieving the above goals are: 1) prospective studies (designed to test specific hypotheses and address specific resource management questions); 2) retrospective analysis (analyzing available data for its applicability to new problems and hypotheses); and 3) integration of research and monitoring programs

(insights into which parameters to monitor are gained through research efforts; new research questions and hypotheses to test can be identified by analyzing trends indicated through monitoring efforts).This phase should include provisions for regular data analyses and publication of the information. It is anticipated that MEMD will provide funds for this phase for 3-5 years. In order to qualify for funds to address Phase III, the reserve must show written evidence, i.e., publications, that the first two phases have been completed.

The funding to support the monitoring program is provided through a competitive process with applicants responding to a request for a proposal issued annually by MEMD. Funding is very modest at this point. In FY 1990, $140,000 was available to the 18 Reserves with a $30,000 limit on Phase I and III proposals and $25,000 on Phase II. Another condition is that the applicant provide an equal match to the grant in services of funds.

A new direction in the NERRS monitoring program is towards generating long-term environmental quality data sets. This monitoring should be 1) continuous, long-term (defined as 10 years and longer). 2) be a component of an associated long-term ecological study to understand structure and function of Reserve natural features, 3) address relevant resource management issues.

The purpose, program and permanence of the Reserves combine to provide an ideal institutional environment to conduct estuarine monitoring resulting in long-term data sets which so seldom exist to define status and identify trends in support of management actions.

The Reserves can also have an important role in other ongoing monitoring efforts. EPA's Narragansett Bay Project provides an example of integrating the on-site NBNERR monitoring with the larger scale NBP program. The NBP has contracted with the University of Rhode Island, Graduate School of Oceanography, to develop a bay-wide environmental monitoring plan to identify risks to intended beneficial uses of the Bay, determine status and trends of selected monitoring parameters which characterize the environmental quality relevant to the perceived risk and then supports management decisions and measures success of management actions. In this context, the Reserve operates a weather station providing the only climatological data from within the parameter of the Bay itself. We hope to shortly design and implement a citizen's water quality monitoring project which will begin the development of a long-term data base for important physical and chemical water quality parameters that are governing factors in the occurrence and abundance of living marine resources in temperate estuaries. Similar programs by citizens, government or educational institutions are envisioned in other segments of Narragansett Bay. These site-specific activities added together will provide a bay-wide understanding of temporal and spacial changes in habitats and living resources.

In turn, regional or national scale monitoring is underway or planned as previously mentioned. I'll leave to others the explanation of the grand scale interrelationships with site-oriented monitoring.

In conclusion I'd like to make the following points:

- The NERRS phased monitoring program is well-conceived, should provide a significant contribution to estuary-wide monitoring projects and should receive more emphasis and funding by the System.

- A principal goal for Reserve monitoring should be to generate long-term (>10 years) data sets relevant to on-site and/or estuary management.

- Developing partnerships and cooperative efforts with Federal, state, academic and citizens groups is the key to conducting cost/effective large scale, estuary-wide programs. An example is the Narragansett Bay Monitoring program presently in the planning stage.

- A lead agency should be designated with the mission and authority and funds to oversee estuary scale monitoring programs which are presently fragmented and duplicative in some cases.

NATIONAL ESTUARINE RESERVE RESEARCH SYSTEM

For additional information on the National Estuarine Reserve Research System, please contact:

Marine and Estuarine Mgmt. Division
Office of Ocean & Coastal Res. Mgmt.
NOS/NOAA
1825 Connecticut Avenue, NW
Washington, DC 20235
(202) 673-5126

The Reserve Research System

Presently, eighteen Reserves in fifteen states and Puerto Rico have been designated. Collectively, they protect nearly 300,000 acres of estuarine waters, marshes, shorelines, and adjacent uplands for research and education. Additional sites are under consideration to expand the System. The diverse environments represented by each Reserve provide a profile of the nation's estuaries —an invaluable tool for coastal zone decision-makers.

NATIONAL ESTUARINE RESERVE RESEARCH SYSTEM

Alabama - Weeks Bay
Weeks Bay N.E.R.R.
Marine Resources Division
Dept. of Conservation & Natural Resources
P.O. Drawer 458
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California - Elkhorn Slough
Elkhorn Slough N.E.R.R.
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(408) 728-0568 728-2822

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Tijuana River N.E.R.R.
Caspian Way
Imperial Beach, California 92032

Florida - Apalachicola
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261 7th Street
Apalachicola, FL 32320
(904) 653-8063

Florida - Rookery Bay
Rookery Bay N.E.R.R.
10 Shell Island Road
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Georgia - Sapelo Island
Sapelo Island N.E.R.R.
Game and Fish Division
Dept. of Natural Resources
P.O. Box 15
Sapelo Island, GA 31329
(521) 485-2251

Hawaii - Waimanu Valley
Waimanu Valley N.E.R.R.
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Natural Area Reserves System
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Maryland - Chesapeake Bay
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Massachusetts - Waquoit Bay
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New Hampshire - Great Bay
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New York - Hudson River
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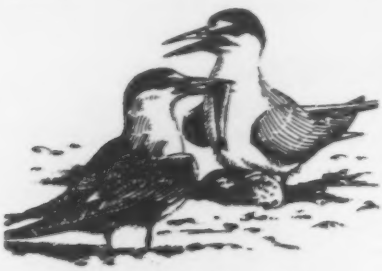
In the late 1960's the United States Congress recognized the need to protect coastal resources from pollution and the pressures of development. In particular danger were the nation's estuaries, those valuable, yet fragile areas where rivers meet the sea. To address threats to these critical areas, the National Estuarine Reserve Research System was established as part of the Coastal Zone Management Act of 1972. The National Oceanic and Atmospheric Administration (NOAA) was given responsibility for designating estuarine reserves and administering the System.



The goal of NOAA's program is to establish and manage, through federal-state cooperation, a national system of reserves representing different coastal regions and estuarine types that exist in the United States and its territories. The Reserves serve as field laboratories in which studies are conducted on natural and human processes occurring within the estuaries.

What is an Estuary?

An estuary occurs where saltwater from the sea meets and mixes with freshwater from the land. These "brackish" waters make up the bays, sounds, inlets, bayous, and sloughs familiar to anyone who has visited the coast. Though they lack the saltwater component, freshwater wetlands found along parts of the Great Lakes' shorelines also have many estuarine-like characteristics. Physical features typical of estuarine systems include narrow river and bay mouths emptying into the sea, barrier beaches protecting the estuary mouth, mudflats, saltwater and freshwater marshes.

Shallow basins within estuaries are warmed by the sun, and organic and mineral sediments in the waters are constantly mixed by ocean tides and currents. The results are fertile arms of the sea that provide food for an immense number of plants and animals either directly or indirectly through a complex food web.

Importance of Estuaries

Estuaries are among the most biologically productive systems on earth. More than two-thirds of the fish and shellfish commercially harvested in coastal waters spend part or all of their lives in estuaries. The economies of many coastal cities are directly linked to both commercial and recreational uses of estuaries. Millions of people enjoy fishing, boating, and related activities and also benefit from the food and employment created by the resources nurtured in estuarine systems. Estuaries also provide other benefits, including storm and flood protection and pollution control, at no cost to taxpayers.

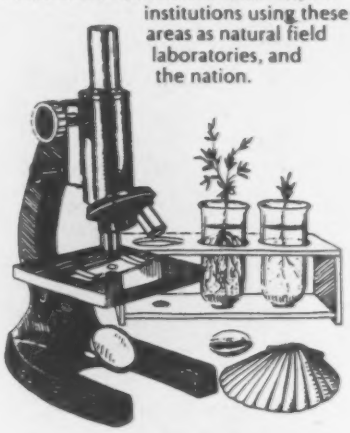
The fragile balance of these productive estuarine environments may be easily destroyed by human activities. Changes in water quality or alterations (dredging or construction) to coastal barriers that protect the mouths of these inlets can lead to destructive changes in the marshes and mudflats that lie behind. The National Estuarine Reserve Research System is providing critical protection to safeguard these irreplaceable natural resources.

Outdoor Classrooms

Education and research are the primary objectives of the National Estuarine Reserve Research System. Educational programs, guided tours, and workshops are offered at most Reserves. Many sites include facilities such as interpretive centers, laboratories, and resource libraries. The public is encouraged to take advantage of these opportunities to learn about their National Estuarine Reserves. Exciting discoveries can also be made during an informal visit, casual hike, or boat trip through these beautiful natural areas.

Research

National Estuarine Research Reserves are being established and managed for long-term environmental monitoring and scientific research. Each site offers opportunities for monitoring changes within the estuarine system and the effects of human activity on these resources. Research efforts in the Reserves involve the active participation of Reserve staff, academic institutions, and independent research foundations. Informational exchanges among researchers benefits the Reserves, the institutions using these areas as natural field laboratories, and the nation.



The results of scientific research programs in the Reserves are important sources of information and data to support coastal zone management and decision-making. Protection of estuaries and the continuation of these research programs are essential to help us better understand our nation's estuaries and what we must do to keep them healthy and productive.

Mr. NOWAK. Thank you very much.

We will now turn to Carroll Curtis, who is a manager, Chesapeake Bay National Estuarine Research Reserve.

Ms. CURTIS. Thank you, Mr. Chairman. I am grateful for this opportunity to be here.

I am a marine scientist with the Virginia Institute of Marine Science, which is a component of the College of William and Mary. The testimony that I will provide today will sound very similar to what I have already heard my colleagues say, but I will be presenting it from a little—slightly different perspective and the fact that our research reserve program is managed as part of a college framework which has a strong academic and research component. Also, we are part of the Chesapeake Bay program, which has for several years proven its ability to coordinate the very difficult and arduous task of multi-disciplinary monitoring and research.

I would like to present a summary of my testimony on the needs for monitoring and increased funding at National Estuarine Research Reserve sites, which I will call NERRS, and on the ways that this monitoring benefits reserve managers and other coastal decision-makers.

NERRS monitoring is designed to provide site-specific, ecosystem-oriented environmental data which will help the on-site manager better manage the reserve and will provide a basis for sound decision-making. NERRS monitoring provides a foundation for understanding how our NERRS ecosystems work, for detecting changes in ecosystem conditions, and for predicting future conditions.

The monitoring data also provides descriptive background information which are useful in basic research. Because reserves are natural areas and are representative of regional estuarine conditions, the information derived from NERRS monitoring can be used in a much broader context, such as in developing coastal design management guidelines, in addressing regional resource protection needs, and in designing restoration of mitigation programs.

The availability of these permanently protected NERRS ecosystems, coupled with the establishment of a stable institutional framework, such as that provided by the on-site manager, makes reserves very desirable as monitoring sites.

It has been our experience that it is a combination of ecosystem-oriented NERRS monitoring, along with short-term basic research and larger-scale, multi-disciplinary estuary-wide monitoring that yields the clearest picture of the environmental conditions and trends in and around the reserves and provides the maximum benefits to coastal decision-makers.

The relationship of NERRS monitoring to that of other monitoring programs varies according to the degree of monitoring activity in the vicinity of the reserve and the appropriateness of existing monitoring data to addressing the issues of importance to the reserve.

In some areas, there are no, or only a few, monitoring efforts in place, and the reserve must start from scratch. In others, there may be monitoring programs, but these may monitor only selected parameters or a portion of the estuary and, thus, do not totally fulfill NERRS needs of assessing the health of the ecosystem. In these

cases, NERRS can utilize existing monitored information but must supplement it with on-site monitoring where needed.

An example of this latter situation is provided by our program in Virginia. Because of our location within the Virginia Institute of Marine Science, which conducts much of the monitoring for the Chesapeake Bay program, many environmental data bases are easily accessible to the NERRS program. In my written testimony, I provide a long list of the data that is available which spans up to 30 years.

We anticipate that NERRS can utilize the information in these data bases as well as those provided by the National Geological Survey's National Stream Quality Accounting Network, EPA's EMAP program, and the list of the programs we have heard today.

So you might ask why, with all this environmental data available, does the Virginia NERRS program need monitoring? Well, we asked the same question of our Research and Monitoring Advisory Committee last fall. We reviewed the status of the Chesapeake Bay program monitoring and research programs, we looked at what was being recommended on a national level, and when we boiled it all down the committee produced a list of 26 information needs which were not being addressed by any other monitoring program, at least not within the estuary or at an ecosystem level.

Some of the committee's recommendations which we will hope to follow up on include monitoring of nonpoint source loadings of nutrient sediments and agricultural chemicals to surface waters; monitoring the effectiveness of natural vegetation in retarding run-off from agricultural, forestry, mining, and development activities; monitoring ground water quality and exchange with surface waters; monitoring the responses of vegetation and fisheries to changes in land use patterns and hydrological conditions within the estuary; and a long list, as I said.

We are now initiating one of these priorities, and that is to establish permanent benchmarks for characterizing wetland community structure at our NERRS sites. These areas will be used for monitoring and predicting how environmental conditions change in relation to sea level rise, land subsidence due to ground water withdrawals, and changes in estuarine salinity regimes resulting from proposed fresh water diversions from the estuary.

In addition to the agency and institutional partnerships which we are forging in Virginia, we are also recruiting citizen monitors to conduct weekly water sampling, monthly bird surveys, quarterly beach clean-ups, as well as assist in our wetland field studies. It is my understanding that other NERRS programs are utilizing citizen monitors as well.

The data from our monitoring program serves multiple users. For example, the data from the wetland monitoring program I just described will or can be used by EPA's EMAP program as well as by the U.S. Army Corps of Engineers, EPA, and Fish and Wildlife Service in evaluating Clean Water Act, for permit applications, by the National Marine Fisheries Service, Fish and Wildlife Service, and State resource management agencies in determining the future viability of fish and shellfish nursery areas and waterfowl production areas, thus, State and local wetland boards, in reviewing wetland alteration permits, and developing shoreline development set-

back guidelines, and by State agencies in setting minimum instream flow requirements and maximum ground water withdrawal limits.

I just want to emphasize that MEMD funding for NERRS monitoring is warranted, given the valuable information that it provides. I will not elaborate since Gene Wright did so in describing what our needs are.

I would like to mention, though, that the funds that MEMD makes available to the States for research and monitoring are generally those portions of their budget that is left over after fulfilling the needs of acquisition, management, development of the sites, and typically this is only a fraction of the amount of money that is needed to fully fund the proposals that MEMD receives. For example, in response to the FY 1990 call for monitoring proposals, MEMD received 11 proposals, of which probably only two or three will be funded.

I would like to close by summarizing the fact that NERRS has become an integral component of the State coastal zone management programs. On-site managers are continually called upon to provide information on the health of the estuary and to express opinions and comments on the probable effects of coastal development and other perturbations. Monitoring is essential to providing this information as well as a way to measure and predict changes in the system, whether natural or human induced. I don't believe that NERRS monitoring duplicates the efforts of other monitoring programs. I believe it complements them.

I would like to close by thanking you for this opportunity and inviting you and any other members of the subcommittee to visit some of our NERRS sites. We would be more than happy to show you what we are doing and demonstrate what a valuable contribution these programs are making to coastal zone management.

Thank you.

[The prepared statement of Ms. Curtis follows:]

NERRA
NATIONAL ESTUARINE RESEARCH RESERVE ASSOCIATION

TESTIMONY OF

CARROLL N. CURTIS, DIRECTOR
CHESAPEAKE BAY NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM IN VIRGINIA
AND
MEMBER, NATIONAL ESTUARINE RESEARCH RESERVE ASSOCIATION

to the

SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH, AND ENVIRONMENT
OF
THE HOUSE COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY

JUNE 26, 1990

Mr. Chairman and Members of this distinguished Subcommittee, I am grateful for the opportunity to submit testimony on behalf of myself and my colleagues. My name is Carroll Curtis. I am a Marine Scientist with the Virginia Institute of Marine Science of the College of William and Mary and the Director of the proposed Chesapeake Bay National Estuarine Research Reserve System in Virginia. I am also a member of the National Estuarine Research Reserve Association (NERRA), which is an association of on-site managers and other state staff of designated and proposed National Estuarine Research Reserves. On behalf of NERRA, I respectively request your support for the re-authorization of the Coastal Zone Management Act of 1986, as amended; and in particular, Section 315 which deals with the National Estuarine Research Reserve System (NERRS). I would like to present our views on the need for monitoring and increased funding at NERRS sites and on the ways that monitoring benefits Reserve managers and other coastal decision-makers.

THE NEED FOR LONG-TERM MONITORING AT NERRS SITES was first recognized by the 1969 Stratton Commission which reported to the U.S. Congress that the nation was seriously handicapped in the field of estuarine science because the number of unaltered estuaries where natural processes could be studied was rapidly diminishing. The Commission concluded that "the nation needed natural laboratories for long-term study of the rhythms and relationships governing the estuarine environment" and recommended that "representative sites should be selected for careful, prolonged study to permit the accumulation of basic knowledge essential for understanding the statics and dynamics of the coastal regime" (Stratton Commission, 1969).

The 92nd Congress agreed with this observation and created NERRS to "provide scientists the opportunity to make baseline ecological measurements, essential to many coastal zone management decisions, and prediction of the impact of human intervention. These areas could be used to monitor vital changes or forecast possible deterioration from anticipated activities. Scientific research and ecological data from these areas could aid significantly in providing a rationale basis for intelligent management of the coastal zone" (S.R. 92-753).

The addition of specific language in House Bill 4030 for the conduct of monitoring activities within the System, including the monitoring of physical, chemical, and biological parameters and criteria associated with the estuarine ecosystem, is in keeping with this original Congressional intent. NERRS monitoring is designed to provide site-specific, ecosystem-oriented environmental data which will help the on-site manager better manage the Reserve and will provide a basis for sound management decisions. NERRS monitoring provides a foundation for understanding how the estuarine ecosystem works, for detecting changes in the ecosystem over time, and for predicting future conditions. Monitoring also provides descriptive background data which are useful in basic research. Because Reserves are

natural areas and are representative of regional estuarine conditions, the information derived from NERRS monitoring can be used in a much broader context, such as in developing coastal zone management guidelines, in addressing regional resource protection needs, or in designing restoration or mitigation programs. Thus, NERRS monitoring not only fulfills site-specific needs but can be used for multiple purposes.

THE ROLE OF RESEARCH AND MONITORING at NERRS sites, whether dealing with the rocky coast of New England, the extensive marshes of the Mid and South Atlantic, mangrove swamps of Florida and the Caribbean, or sloughs of the Pacific Northwest, is to enhance scientific understanding of estuarine ecosystems and to improve coastal decision-making. NERRS research is designed to test ecological theories concerning environmental stability, ecological diversity, community structuring, and ecosystem development. It employs the scientific method of making observations, posing hypotheses, and conducting carefully controlled studies. At NERRS sites, basic scientific endeavors also should have practical management application. The Marine and Estuarine Management Division (MEMD), which administers the Federal funding for NERRS, has identified national research priorities which are applicable, in a generic sense, to all of the NERRS sites.

NERRS monitoring, on the other hand, provides standards of reference for detecting changes in the condition of the Reserve environment. It involves the continuous collection of consistent, statistically rigorous environmental data over long periods of time--from years to decades. By protecting entire ecological units, NERRS monitoring can focus on ecosystem-level questions. The availability of permanently protected "ecosystems," coupled with the establishment of stable institutional frameworks, such as those provided by NERRS managers, make Reserves very desirable as monitoring sites. The design of an effective monitoring program and the availability of adequate funds to carry it out are equally important.

Choosing what to monitor is paramount to the success and usefulness of the NERRS monitoring program. Since it may not be possible to predict, now, what information will be useful or required in the future, the development of a NERRS monitoring program must be an evolutionary process. It involves a phased approach to identifying current or anticipated ecological issues facing a Reserve and selecting parameters and measurement techniques which hold maximum potential for long-term applicability and utility of results. The design phase also takes into account what is being studied or monitored by other institutions or agencies and the usefulness of this information to addressing Reserve management issues. Often, it is the combination of ecosystem-oriented NERRS monitoring, along with short-term basic research and larger-scale, multiple-agency, estuary-wide monitoring, that yields the clearest picture of environmental conditions and trends in and around Reserves and provides the maximum benefit to coastal decision-makers.

THE RELATIONSHIP OF NERRS MONITORING TO THAT OF OTHER MONITORING PROGRAMS varies according to the degree of monitoring activity in the vicinity of the Reserve and the appropriateness of existing monitoring data to addressing issues of importance to the Reserve. In some areas, there are no or only a few other monitoring efforts in place and the Reserve must start from scratch. In other areas, there may be monitoring programs, but those programs may monitor only selected parameters or a portion of the estuary and thus do not totally fulfill NERRS needs of assessing the health of the ecosystem. In these cases, NERRS can utilize existing monitored information and supplement it with NERRS monitoring where needed to document environmental conditions within the Reserve. An example of this latter situation is provided by the proposed Chesapeake Bay NERRS in Virginia.

From its inception, the Virginia NERRS program has sought the cooperation of a variety of Federal and state agencies, many of which are involved in the Chesapeake Bay Program. The Virginia sites have a history of use as

research and monitoring sites, are likely to attract continued research interest and funding, and are ideal for addressing national, Bay-wide, and site-specific research and monitoring needs. The Chesapeake Bay Program envisons them as being used for defining the functional relationships of coastal habitats and for monitoring the health status of these habitats in relation to development within the Bay watershed. The Governors of Virginia and Maryland have agreed that to cooperate and coordinate in the development and management of Chesapeake Bay NERRS sites will further comprehensive efforts to restore and protect the Chesapeake Bay ecosystem.

As the Virginia NERRS program moves into the operations phase, with designation occurring this September, it is seeking ways to enhance multiagency coordination of research and monitoring efforts. Alliances are being made with instutitions and agencies which already collect environmental data at or near Virginia NERRS sites in order to avoid duplication of monitoring efforts, minimize costs, and maximize data usefulness. Because the Virginia NERRS headquarters is located at the Virginia Institute of Marine Science (VIMS), which conducts much of the monitoring for the Chesapeake Bay Program, many environmental data bases are easily accessible to NERRS. These include data bases from the following VIMS programs, to name a few: Environmental Monitoring (which has produced nearly 30 years of data on wind speed and direction, rainfall, solar radiation, air temperature, and relative humidity at Gloucester Point); Slack Water Monitoring (which, in conjunction with the State Water Control Board Tributary Monitoring, has provided nearly 20 years of monthly data on water column salinity, temperature, and dissolved oxygen and 6 years of monthly data on dissolved nutrients, suspended solids, and chlorophyll-A in Virginia's tributaries); Tide Monitoring (which has provided 19 years of continuous, real-time tidal data); Fisheries Monitoring (which has provided routine monthly trawl surveys for finfish and blue crabs in the York, James and Rappahannock Rivers and monitoring of juvenile striped bass in Virginia

nursery areas since 1967); Phytoplankton Monitoring (which has provided 8 years of data on long-term trends in species composition and/or abundance in relation to eutrophication or nutrient enrichment); Submerged Aquatic Vegetation Surveys (which have annually mapped the distribution and abundance of SAV since 1984); Coastal Erosion Surveys (which have measured and monitored shoreline changes since 1975); Effluent Monitoring (which examines industrial and municipal effluents to identify those that contribute toxics to the Chesapeake Bay and its tributaries and to establish an inventory of pollutants in the system); and PCB and Tributyltin Monitoring (which was initiated in 1986 to analyze water samples for the occurrence of organochlorines and biocides). We anticipate that NERRS can also use data from the Chesapeake Bay Program's Living Resources Monitoring and Stock Assessment Programs, the U.S. Geological Survey's National Stream Quality Accounting Network (NASQAN), and NOAA's National Status and Trends Program and can potentially contribute to EPA's Environmental Monitoring and Assessment Program (EMAP), the National Science Foundation's Long-Term Ecological Research (LTER) Program, and the United Nation's Man and the Biosphere (MAB) Program.

You might ask why, with all of this environmental data available, does the Virginia NERRS need a monitoring program? We asked this same question of our Research and Monitoring Advisory Committee last fall and the Committee produced a list of 26 information needs which were not being addressed by any other monitoring program, at least not at an ecosystem level. Some of the Committee's recommendations for NERRS include: monitoring non-point loadings of nutrients, sediments, and agricultural chemicals to surface waters and the effectiveness of natural vegetation in retarding runoff from agricultural, forestry, mining, and development activities; monitoring groundwater quality and exchange with surface waters; monitoring the responses of vegetation and fisheries to changes in land use patterns and hydrological conditions within the estuary; monitoring to identify criteria

and standards for wetland mitigation; and monitoring boating impacts, including the effects of boat wakes on wetlands and the accumulation of trash and debris on beaches. We are now seeking support from MEMD and the VIMS Wetlands Department to initiate one of these priorities; that is, the establishment of permanent benchmarks for characterizing wetland community structure at NERRS sites and for monitoring and predicting how these conditions change over time in relation to sea level rise, land subsidence from groundwater withdrawals, and changes in estuarine salinity regimes resulting from freshwater diversions for public supply.

In addition to agency and institutional partnerships in environmental monitoring, the Virginia NERRS program has—recruited citizen monitors to conduct weekly water sampling, monthly bird surveys, and quarterly beach clean-ups as well as to assist in wetland field studies at NERRS sites. Other NERRS programs are utilizing citizen monitors as well.

DATA FROM NERRS MONITORING PROGRAMS SERVES MULTIPLE USERS. For example, data from the Virginia NERRS wetlands monitoring program on the impacts of sea level rise, land subsidence, and freshwater diversions can be used not only by the Reserve manager, but also by the U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, and U.S. Fish and Wildlife Service in evaluating Clean Water Act Section 404 Permit applications; by the National Marine Fisheries Service, U.S. Fish and Wildlife Service, and state resource management agencies in determining the future viability of fish and shellfish nursery areas and waterfowl production areas; by state and local wetland advisory boards in reviewing wetland alteration permits and in developing shoreline development set-back guidelines; and by state agencies in setting minimum instream flow requirements and maximum groundwater withdrawal limits.

MEMD FUNDING FOR NERRS MONITORING IS WARRANTED to maximize program potential. Through a highly competitive proposal process involving rigorous peer review, MEMD provides funds for those projects which will best contribute to the understanding of Reserve sites and the improvement of coastal management. Generally, MEMD monitoring funds consist of that portion of its annual appropriation which is "left over" after obligations for the acquisition, development, and operation of designated sites and the predesignation needs of proposed sites are taken care of. Typically, only a fraction of the monitoring proposals that are rated excellent by both peer reviewers and MEMD staff are funded by MEMD because of budgetary constraints. In response to the FY 1990 call for monitoring proposals, for example, MEMD received 11 proposals, of which only 2 or 3 can be funded given limited funds.

The opportunities missed or inadequately funded by state, local, or private funds alone reflect a growing threat to the health of Reserve environments and a failure to meet the goals and objectives of NERRS. An adequate investment of Federal dollars will provide the seeds for much larger returns now and in the future. It should also be noted that the minimal Federal dollars provided through MEMD attract supplemental funds from other Federal agencies, states, local governments, and private foundations. At Waquoit Bay NEER in Massachusetts, for example, MEMD and state support are a major reason why Waquoit Bay NEER was chosen by the National Science Foundation for a 4-year $2 million Land Margin Ecosystem Grant. In Virginia, even before designation, the NERRS program received a gift of $25,000 which has been used to set up an endowment to provide stipends for summer research assistants.

IN SUMMARY, I would like to emphasize that NEERS has become an integral component of state coastal management programs. On-site managers are continually called upon to provide information on the health of the estuary

and to express opinions and comments the probable effects of coastal development and other perturbations. Monitoring is essential to providing this information and a way to measure and predict changes in the system, whether natural or human-induced. NERRS monitoring does not duplicate the efforts of other environmental monitoring programs, but complements them. NERRA respectively requests this Subcommittee to support the addition of a provision for NERRS monitoring in Section 315.

The success of NERRS is possible only through adequate funding of Section 315 state grants. States have shown their support for the program by forging strong cost-sharing partnerships with MEMD and by developing alliances with other coastal and estuarine programs, but they alone cannot provide all of the necessary resources. NERRA respectfully urges this Subcommittee to recommend $5.74 million in FY 1991 appropriations for NERRS. This amount will ensure the continuation of Federal/state efforts to protect and manage the only national network of representative estuarine areas which aid in coastal management through coordinated research, monitoring, and education programs.

MY FINAL COMMENTS pertain to the status and needs for additional interagency coordination between NERRS and EPA's EMAP and NOAA's Status and Trends programs and between NERRS, CZM, and the National Estuary Program, particularly with regard to developing a sound national marine and coastal monitoring program. I would like to make the following recommendations as they pertain to Virginia in the hopes that these recommendations are appropriate for other coastal regions of the country.

WITH REGARDS TO EPA's EMAP PROGRAM, I encourage EPA to coordinate with NERRS programs for demonstrations on the suitability and desirability of small scale monitoring within the overall framework of EMAP. Dr. Robert J. Huggett of VIMS serves on EPA's Science Advisory Board for EMAP and advises

me that NERRS sites could play a prominent role in EMAP because of their protected status and the availability of information accumulated to date. As you are aware, a demonstration project involving the Virginian Province will commence this summer to demonstrate the concept of a meaningful large scale monitoring program. It is our hope that NERRS sites will figure into the demonstration project.

WITH REGARDS TO NOAA's STATUS AND TRENDS PROGRAM, I encourage the continuation and possible expansion of this program to include additional sites and increased sampling frequency. In the Chesapeake Bay, for example, samples are only collected from the main stem of the Bay. Sampling sites within clean and polluted areas of the tributaries are needed to better characterize the prevalence of contaminants in sediments and shellfish. I encourage the Status and Trends Program to utilize NERRS sites for assessing natural background contaminant levels.

WITH REGARDS TO THE NATIONAL ESTUARY PROGRAM, whereas the Chesapeake Bay Program is not exactly a NEP program, there are some similarities which can be extrapolated to other estuaries. In the Chesapeake Bay, much of the effort to date has focused on main stem water quality conditions and the stocks of recreationally and commercially important fish and shellfish. More consideration needs to be given to environmental conditions within the tributaries and to assessing the functional role of coastal habitats. Here, NERRS can be utilized by NEP programs to help assess status and trends in coastal habitat quality.

AND FINALLY, REGARDING THE RELATIONSHIP BETWEEN NERRS AND CZMA, NERRS sites are being used to generate information that is useful to state and local coastal resource managers and decision-makers. Not only are they used for directed research efforts, but NERRS sites also provide an educational service that has relevance to coastal resource management. NERRS sites are

visited by school groups, decision-makers, and the general public and are used for hands-on interpretive and demonstration programs. In many ways, NERRS sites play an important role in bridging the gap between science, education, and decision-making. Efforts should be made to see that this role is maximized to its fullest.

I WILL CLOSE THIS TESTIMONY by thanking you, Mr. Chairman and Members of this distinguished Subcommittee, for the opportunity to express views and opinions on NERRS, and by inviting you to visit the Virginia NERRS sites to see firsthand the valuable contribution this program is making towards improving our knowledge of estuaries and the ways we deal with problems confronting them. We would be honored to have you join us for a field trip. Thank you.

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Mr. NOWAK. Thank you. Thank you all very much.

You all have a common thread, I think, in your testimony, in going through some of the other detail that you have submitted, bringing together a program that is certainly long-term and a sustained effort to be a very important phase so that you don't disconnect, then have to pick up later and duplicate all the things that are going on. And certainly the funding of the Federal portions of what is being put together out there is going to have to be sustained.

We went through a period here where there was a new Federalism, if you will, to turn everything back to the States because they wanted to do these programs on their own, and that hasn't seemed to enhance the type of program that is going to produce results in a field like this. We can do that in some areas, but when we talk in terms of even the budget discussions that we are going through now, statements were made, well, that it is almost like being cheerleaders up here; we cheer for the States to raise taxes, and they raise taxes that fit States; if they don't, you know, they are not doing their job, and we don't do that here, we enhance revenue.

But we are going to have to, you know, start to look at these things, and the other, from our point of view, trying to bring together—several years ago, we put in—(I've got the Water Resource Committee)—put in the Great Lakes National Program Office to try to coordinate, as you well know, the research that was being thrown out in the Great Lakes and get the universities and get the private groups together so that somebody had a handle on where the dollars were going to be spent and we are able to set some priorities so that everybody's contribution moved the whole process forward. And, you know, we didn't go sideways with the limited amount of Federal dollars and State dollars that are being used out there, and I take it that this whole area or type of program that NOAA and EPA have are going to have to be more closely in tune, especially when you look at all of the different types of research that are moving forward very quickly.

Mr. Wright, you mentioned the zebra mussel problem, from a point of view of cost and so forth. You know, we have an initiative moving through the House Merchant Marine Committee to provide $20 to 25 million worth of research in that particular area, and I think you mentioned the reduction in the amount of plankton that is going to be available, and if that happens, of course, and that continues, as is anticipated, that could, in some people's minds, just destroy the whole reproductive process, if you will, because I understand it is not only the plankton, it is tremendous amounts of oxygen that are consumed when the breeding level produces the amount of zebra mussel that is anticipated, and I wondered if your program is going to do more in that area and how you could see, you know, that particular area being managed.

Mr. WRIGHT. Yes, I did mention one study that we might want to do is to determine the feeding patterns and feeding rates of zooplankton on the phytoplankton. In addition—that is the wrong one. Okay, the same scientist wants to further this study to determine the impact of zebra mussels on zooplankton numbers and species composition. This will be done by comparing natural zooplankton

in enclosures with zebra mussels to natural zooplankton enclosures without zebra mussels.

Then that goes on too, already we have a project on site with the U.S. Fish and Wildlife Service that, while they were looking at selected feeding habits of some of the game and forage fish of Lake Erie, they realized that all of the samples that they had already taken probably contained—some of them contained a veliger stage of zebra mussels, so we are going back and reexamining those same samples to determine that.

In our own case, we would not necessarily, per se, carry on the research, but we certainly provide the support facilities and coordination abilities to work with the Fish and Wildlife Service and the Ohio Sea Grant Program, and other agencies. Again, we need some more money to do that.

We are not really entirely sure of the impact of zebra mussels on the Great Lakes ecosystem. We know that they do clog up water intakes and that affects the drinking water, nuclear power reactor intakes for cooling—that is a problem—and we also know that, in controlling their numbers sometimes the methods cause reactions and changes in the aquatic environment that are worse than the initial problem was, too. So there is an awful lot of work that needs to be done, and we feel we are at a place that we could provide coordination and facilities and monitoring in some cases.

Mr. NOWAK. Another health-related concern has been raised, too, in terms of, even if the zebra mussel doesn't get through the screenings that everybody has erected for the drinking water supply, I understand the zebra mussel, when it dies, if—and it can contain some type of parasite that is in it.

Mr. WRIGHT. That certainly is a potential.

Mr. NOWAK. Which could flow through that system and into the drinking water. Have you any information on that?

Mr. WRIGHT. Not yet. That is a consideration, and we know the breakdown of the organic materials from the zebra mussel, again, could cause toxic problems that we are not even aware of yet. There needs to be more work done, more money, more time.

One thing, as an aside from that, sir, is that information thus far might suggest that the young of the year sport and commercial fish, in particular, like the walleye or perch in the Lake Erie system, at a certain point in time, when they are consuming, their yolk sac or their egg sac, that they rise up into the water column and become planktonic feeders. That might become a real important or significant time where maybe there won't be as much plankton available right at that point in time. So some time down the road, so to speak, we may end up with some year-age classes with gaps in numbers. That is a potential, though we don't really know that yet and are looking into that, again, with the Fish and Wildlife Service and Ohio Sea Grant, and us, together.

Mr. NOWAK. I guess in all your testimony you have come to the basically same conclusions: As we are going through, hopefully, coordinated, sustained long-term research, we come up with the kinds of decisions that really give us and give your State legislators and give the governors and people who are going to make decisions good basic information, and I wonder if you felt that both the EPA and the NOAA programs that are out there will tend into that

kind of direction. Is the system, as you know it now and as it is being pursued—will it lead us to those types of decision markers, if you will?

Mr. BLIVEN. Yes, I think over time they will. The important point, though, is to make sure that they have enough time to function and that they don't get caught in the budgetary waxing and waning.

The monitoring programs that are set up through the Estuarine Research Reserves have a particular advantage in that they are jointly funded by State and Federal entities. In the Massachusetts situation, particularly during the period of New Federalism you referred to, Massachusetts happened to be in the midst of a miracle. These days, we are not as miraculous as we once were, but there is more money available through the Federal Government.

Having two partners in there allows for that sort of waxing and waning to sort of level off. I think, secondly, the research reserves have put a fair amount of money into establishing on-site facilities. It is much harder to cut off a program where there is a facility existing than one where you essentially are taking samples, shipping them to a commercial testing center. Those are fast to start off; they are also fast to stop.

As far as the Status and Trends Program, I think it is set up in a—first of all, it was set up with a limited budget, with an eye towards an extended future. They are, as my testimony suggests, sampling for integrators. It allows them to come back over a more extended period of time, and it allows them to use the organisms that are being tested for a much broader range in time and space. The EMAP program focuses, at least in the coastal areas, much more on water quality; it gives you a better real time sense of what is going on but requires a lot more samples and a lot more time.

So a direct answer to your question: Yes, they can lead there if they, with their particular monitoring and research design, are allowed to extend over a period of time.

Mr. NOWAK. Mr. Beck, could you comment on that? Do you see it running in that direction?

Mr. BECK. I think that in Rhode Island we may have an example of that. What we have is the fortunate circumstance of having a national estuary program in the same estuary that we have a research reserve. The National Estuary Program is essentially conducted at the State level.

In our case, the State project is out of the Department of Environment in the State. The Federal Government guidance comes through the regional office, regional EPA office in Boston, but the people who manage Narragansett Bay are essentially at the State level. Programs have been delegated down to those people. They are the ones that need the information. They are also the ones that are involved in the Narragansett Bay project. They are also the ones who are involved in the steering committee that is developing the monitoring plan on a bay-wide basis.

So I see that in that sense, where we have the fortunate circumstance of those two programs in one geographical area, that there is a coming together. I can see in my own mind how the reserve fits into that, and I think that since we have a protected location, institutionally a secure situation, we can devote ourselves as part

of that overall plan to these long-term data sets in undisturbed areas so that we can identify natural variability and some increasing trends that might indicate problems in water quality or environmental quality of the bay.

So I think that that kind of partnership needs to be encouraged. There may be other ways of doing it where you don't have the circumstance of two EPA and local programs in one geographical region, but as there are more reserves and more national estuaries designated, I think the possibilities for this will increase in the future.

Now, also the national programs for EMAP and the national status and trends also have some overlap, and there are some elements of that that can be useful on an estuary basis. They can help us to understand where our estuary might fit on a national scale: Are we on the down side in the pollution index, or are we relatively healthy? So that also has an impact.

I think you can see that if there is some kind of estuary-wide framework in place, that these other monitoring projects can be integrated and linked to it in a very useful way for those people at the State level who are actually in the front lines of management.

Mr. NOWAK. Ms. Curtis, could you comment on that also? You know, should there be more than one long-term Federal research and monitoring program?

Ms. CURTIS. I think they all complement each other. I think each has its own needed place and focus. From the NERRS perspective, we focus on ecological units that are defined by watershed boundaries. This is a smaller scale than what the EPA's EMAP program envisions. Theirs will be estuary-wide, encompassing many ecosystems that are tied together by physical and hydrological parameters.

I think many of the States have the infrastructures in place to take advantage of the information that is derived from these monitoring programs and utilize it within the State government as well as down in the localities.

In our State, our coastal zone management activities take place at the county level, and we have a mechanism of providing the science and technical information through advisory boards and committees, through our outreach program from the scientists to the counties and to the State agencies, and so I think that—that each State is in a unique situation and has to blend and mold its relationship with the Federal monitoring program to suit its own needs and, vice versa, to contribute to the national needs.

Mr. NOWAK. Yes.

Mr. WRIGHT. If I could comment from our perspective on that question, commencing last autumn, after the research conference that I mentioned on the Great Lakes that was held at Old Woman Creek and then more recently during my participation in the national coastal zone managers meeting here in Washington, D.C., for the first time in 10 years I noticed—I found a recognition amongst us various agencies, like the 306 program managers, section 315 program managers—that's us—recognizing that we were out there for each other, and since that time there has been a new dialogue opening up, at least in our region. We are hearing from EPA and the Fish and Wildlife Service and other NOAA agencies, and we

are doing the same thing. It is a new climate of information exchange that is very promising and, again, an attempt to coordinate rather than duplicate, and I am most encouraged by this new climate.

Mr. NOWAK. Dr. Mooers, when you talk about satellite ocean remote sensing, I have staff here with these pictures. These are sensing pictures that were taken by somebody in Michigan.

Mr. WRIGHT. Lake Huron, Ohio, to me.

Mr. NOWAK. This: the Great Lakes. This is one of the larger in North America. And I was wondering if you could tell us—how much detail can you pick up in the satellite? They are saying that they can be controlled to stay in a framed area for some period of time and take a series of pictures or images. How much detail can you get over what type—what is the status of the ability of satellites to pick up everything from pollution in water to an oil spill to all of the other—I was even wondering on our ability to pick up, but I wonder if you could describe all of the various—

Mr. MOOERS. I'm glad you saved the easy question for me, Mr. Chairman.

There are various ways to organize the answer to your question—questions. First of all, there are two broad types of satellite missions. There are the polar orbiting missions, and there are the geostationary missions, and the geostationary missions are the ones where the satellite is parked in orbit and you can have rapid repeat pictures of a fixed area, whereas the polar orbiting satellites—as I say, the NOAA satellites repeat every 90 minutes, but in the meantime they have gone around the world picking up information, so they give you a really global data set, and then, within the family of polar orbiting satellites you can do a number of different missions, depending on the orbital parameters. Like the angle you incline the satellite relative to the equator can determine how frequently you repeat. There are satellites that repeat, let's say, every three days; others repeat every 17 days; and so forth, as well as the NOAA satellites repeat every 90 minutes.

Now satellite sensors which come in a large variety. One type of sensor is the image type, the type that you showed us, that takes a picture in some band of radiation. It might be a visual band, just like our eyeballs provide, or it could be infrared temperatures—infrared band, which picks up temperature information, or it could be a radar image, and then there are satellites which have specialized functions like radar altimeters that determine the height of the sea surface, so you can see the high pressure and low pressure areas of the sea surface which are analogous to the high pressure and low pressure areas of the atmosphere.

In the category of image sensing satellites, for example, the NOAA infrared imager has a spatial resolution of approximately one kilometer, so—roughly half a mile. So it picks up relatively fine features. But the Landsat imagers have even higher resolution. They are in the—mainly in the optical domain, so they pick up things like the color of vegetation and soils. So they can get down to scales of the order of 100 meters or so.

In some cases, you can see actual phenomena on the sea surface that you are interested in; in other cases, you are provided with a lot of information with which you can draw inferences. For exam-

ple, the coastal zone color scanner, the ocean color imager—another name for the specific mission is SeaWIFS—senses in a band which is optimized for seeing the color of the ocean, and the color of the ocean is in proportion to, near the coast, the suspended sediments in the water column. A little further from the shore, and then throughout the great central areas of the ocean, the color is largely determined by the quality of the phytoplankton. So even though a color sensor doesn't image phytoplankton, per se, for you, it gives you information on the color. With in situ studies, then you can take that color information and make inferences on the amount of chlorophyll that is in the water and therefore the amount of phytoplankton, and so with that ocean color imager we can actually—what has been available in space—make estimates on how much phytoplankton there are throughout the entire ocean.

Does that help some?

Mr. NOWAK. If you had, you know, for instance, a shallow area estuary—suppose you went to the Chesapeake estuary or you went to Narragansett, and you started out in a small area and started to expand that area so you could get into the whole geographic input of water and you could move the camera through a particular river or stream from the starting point of that water where it is spilling, you know, into that estuary, could you pick up discolorations from run-off of particular kinds of wastes?

Mr. MOOERS. The potential is there under maybe not all conditions but some conditions. It reminds me of your earlier question where now you can see oil spills from satellite imagery. For the larger oil spills and the right environmental conditions they can be detected. For the Chesapeake Bay case you cite, satellite remote sensing would be valuable for getting a good picture of the structure of the Chesapeake Bay overall and how it is connected together as a system.

I think for your specific question of being able to trace something that has been entered into a river that is flowing into the Chesapeake Bay, I would actually recommend consideration of airborne remote sensing as a way to obtain higher resolution and more specific information than is logistically practical from a satellite.

Mr. NOWAK. We had talked about dumping of waste from ships; we could pick that up.

Mr. MOOERS. It depends upon the nature of the waste, but yes, there are—

Mr. NOWAK. Sediment build-up, river run-off, sea surface temperature, and currents. So you could actually, if you had the dollars available and the satellite out there, at this point in time, you could get yourself a wealth of information that is feeding the estuary that you are sitting in, not knowing where it is entering from, and everybody says, well, we have taken care of all the nonpoint, or the point source pollution, and of course in every city—in Boston, in New York City—you have something called combined sewer overflow, and where we have invested in the cities hundreds of millions of dollars to go from primary to secondary, we haven't touched the combined sewer overflow. So on a nice sunny day, you go out there, and you could take your picture, and there wouldn't be any overflow, and there wouldn't be a source that you could

identify that day. You go back on a rainy day, if you could take that picture, then you would know what is loading up your estuary. Is that correct? Or when pesticides are put on a farm, you could pick that up perhaps, especially when they enter the watershed?

You look at a watershed, and you look at the Great Lakes, and you say, well, you know, we go to Chicago and we say, you know, this water flows in this housing development 10 miles away; the urban run-off is the waters hitting the cars and picking metals, picking up dirt, and throwing it into the stream that eventually flows in through, in the occasion of the watershed, to the—whether it be the Great Lakes or it be your estuary in Narragansett or in the Chesapeake, and you could start to identify, could you not, at least broad sources of some things moving into your—without being on the actual land, trying to measure that. Is that correct?

Mr. MOOERS. You can do that in some cases, and if you can do it by remote sensing, it is generally much more informative and efficient than by any other alternative.

Mr. NOWAK. Wouldn't it be very clear if you could get a break in the watershed to take a photo of the flow through, say, a farm land community that has just loaded up an area with pesticides and take the same picture on the other side of the flow, where the geographical break is?

In the Great Lakes, of course, you could go out in some of the areas 125 miles and pick up the rain that is going to fall, whether it has got acidity in it or not. It runs off the farm, gets into a little stream that eventually gets into the river, that eventually enters in the lake. I mean, don't we feed all of our estuaries in the same way? You are going to have the so-called salt water backing in and the fresh water hitting it at some point in time. Wouldn't that be helpful, a sensing kind of a program like that?

Ms. CURTIS. I think it would be helpful, but I would like to also comment that one thing we have discovered in the Chesapeake Bay is that there are two other contributors to water quality conditions that I'm not sure could be adequately studied through sensing, and one is the input from ground water input to the bay that carries pesticides and nutrients. The other is the input from atmospheric deposition, whether that can be detected in your overall picture.

Mr. NOWAK. I'm sorry, I was reading a note. Could you just go over that? We have a—the Dannemeyer amendment is pending for a 5 percent cut to all NOAA programs—no, it isn't.

Go ahead. I'm sorry, what was your response to that? I got the first part, and then the bells rang. Go ahead.

Ms. CURTIS. To mention that there are two contributors to water quality problems in the bay.

Mr. NOWAK. Other than what we had mentioned here.

Ms. CURTIS. Right, and one is ground water input which carries a lot of your agricultural pesticides and nutrients into the estuary, and the other is atmospheric deposition which I was saying I didn't know whether remote sensing—

Mr. NOWAK. The ground water input—when you are talking about aquifers, though, you would—

Ms. CURTIS. I am talking about shallow water lateral movement as it percolates down into the fields, then it moves laterally, and there is evidence to suggest that it can contribute up to as much as

30 percent of the nutrients—nonpoint source nutrients getting into the bay.

Mr. NOWAK. You know, that varies so much. I mean, we had testimony that, you know, the acid rain is causing 50 percent.

Ms. CURTIS. Sure.

Mr. NOWAK. I add up all those percentages, and I'm getting 300 or 400 percent.

Ms. CURTIS. Right, right.

Mr. NOWAK. But that is a good question. I mean that is a good—it would slowly reach. But I am saying at least in these rush periods where you have the flushing out of the system, you could start to identify, especially if you are talking about, you know, the trial and tribulations of trying to test the combined sewer overflow, and, you know, if it is not raining—of course, if it is flowing when it is not raining, you have got a real problem. But if it is raining and you have got that flushing out of the systems, you know, that, it seems to me, to be becoming a larger and larger portion of the new pollution coming in, at least, to the Great Lakes and those other areas where we have upgraded the secondary and seen no improvement or seen very minimal improvement.

Of course, another source could be just what you mentioned.

Ms. CURTIS. One thing we are learning is that the width of natural vegetation that you have around the agricultural fields or housing developments or whatever and the estuary helps to pick up those nutrients and pesticides as they move in this lateral water movement. So that could be remotely sensed as to how wide your band of protection is.

Mr. NOWAK. Mr. Beck, did you want to add anything?

Mr. BECK. I just was thinking of what Dr. Mooers said about aerial overflights as may be more appropriate in a lot of cases that would benefit from airborne surveillance. It gets you on the scale that you need for point source management or nonpoint source management in estuaries.

Mr. NOWAK. You know, maybe it could lead—if you had some of the sensing from up above, it would lead you to a little quicker solution or identification of possible entrants into it.

I am sorry, but we are going to have to cut this hearing short, although I have other things I could go over. We have another hearing coming into the room at 2 o'clock which they have to prepare for, and I have to vote against the Dannemeyer amendment.

Thank you very much for attending, and we will submit further questions for you. The meeting stands adjourned.

[Whereupon, at 1:36 p.m., the subcommittee was adjourned.]

APPENDIX

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

AUG 24 1990

OFFICE OF CONGRESSIONAL
AND LEGISLATIVE AFFAIRS

Honorable James H. Scheuer, Chairman
Subcommittee on Natural Resources,
Agriculture Research, and Environment
Committee on Science, Space, and Technology
U.S. House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

In response to your letter of July 3, 1990, please find enclosed responses to additional questions provided following the June 26, 1990, hearing before the House Subcommittee on Natural Resources, Agriculture Research and Environment on coastal environmental monitoring. In addition to the responses and figures enclosed, a map (figure 1) is provided that shows the near coastal sampling stations being used by both the Environmental Protection Agency's Environmental Monitoring and Assessment Program (EMAP) and the National Oceanic and Atmospheric Administration's National Status and Trends (NST) Program in the Virginian Province (approximately Cape Cod to Cape Hatteras).

The Office of Management and Budget has advised that it has no objections to the presentation of these views from the standpoint of the Presidents's program.

Thank you for the opportunity to answer your questions. If there is any additional information that we can provide to you, please do not hesitate contacting us.

Sincerely yours,

Thomas C. Roberts
Acting Director
Legislative Analysis Division

Enclosures

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HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

Hearing Before
The Subcommittee on Natural Resources,
Agriculture Research and Environment
on
Coastal Environmental Monitoring

Answers to Questions for Dr. John Skinner
Deputy Assistant Administrator for Research and Development
U.S. Environmental Protection Agency

1. Describe the ecosystem types and identify how many of these EMAP ultimately intends to assess.

The Environmental Monitoring and Assessment Program (EMAP) represents a commitment on the part of the U.S. Environmental Protection Agency (EPA) to assess and periodically document the condition of certain of the Nation's ecological resources.

Initially, EMAP will be focused on estuaries. The reasons for the initial emphasis on estuaries are:

* Natural estuarine hydrodynamic and chemical processes concentrate and retain pollutants. As a result, the Office of Technology Assessment concluded in 1987 that estuaries are the most degraded of the near coastal ecosystem types.

* The environmental quality of estuaries is strongly influenced by conditions occurring on the landscape as well as by conditions in coastal waters. Therefore, information on the status and trends of estuarine resources should provide information on the ecological condition of other near coastal ecosystem types as well as the landscape draining into estuaries.

* Estuaries provide critical spawning and nursery habitat for many commercially and recreationally important fish and shellfish and migratory water fowl. Protection of these habitats is important to the maintenance of fish and shellfish populations and harvests.

* Demographic projections indicate that estuarine watersheds will continue to be heavily urbanized through the 1990s further increasing the extent and magnitude of anthropogenic stresses on these valuable natural resources.

Theoretically, EMAP techniques could be applied to other ecosystems such as forests, agroecosystems, lakes and streams, air lands, and wetlands. However, due to funding uncertainties and competing priorities, we cannot identify how many of these will ultimately be addressed at this time.

2. Identify the sites that will be monitored under EPA's Ecological Monitoring and Assessment Program (EMAP) and NOAA's National Status and Trends (NS&T) sites, and any overlap that exists.

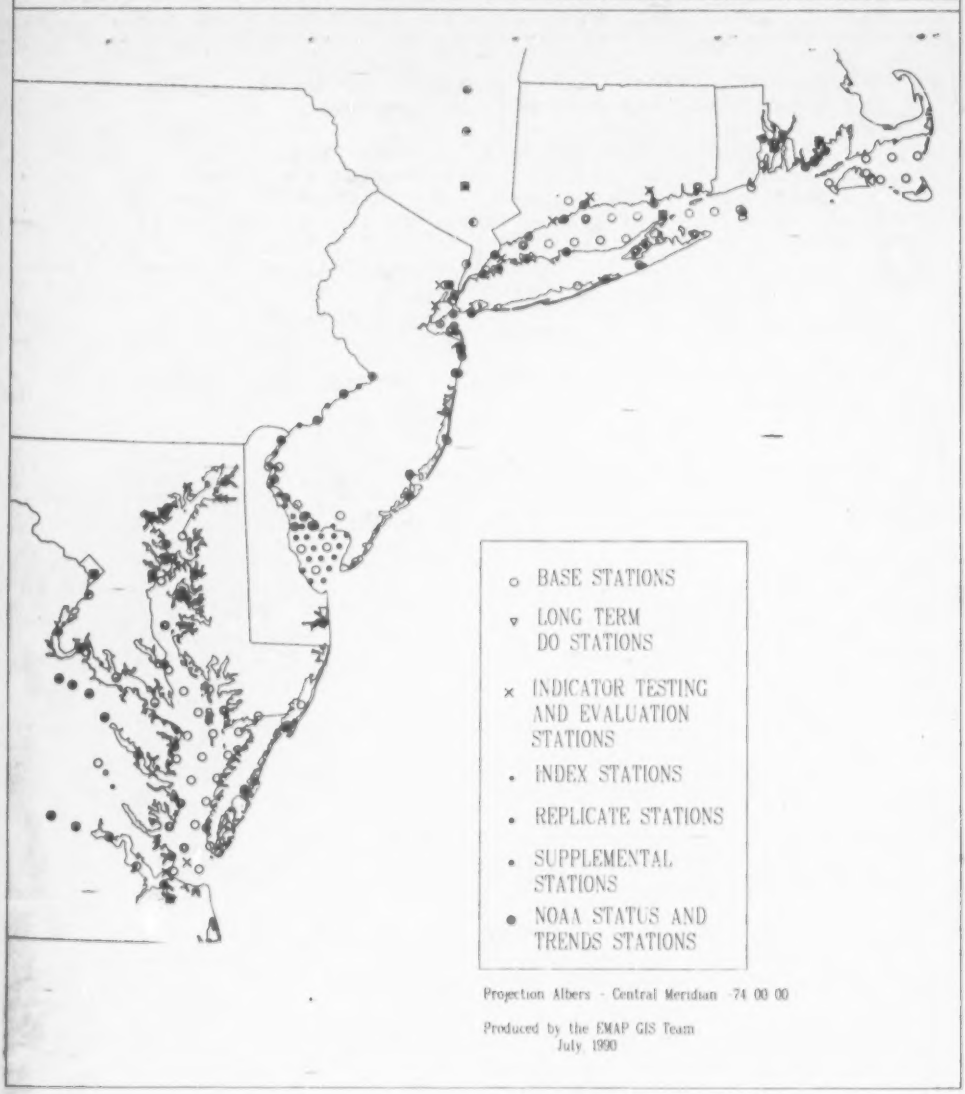
The NOAA Status and Trends Program measures the degree of contamination in oysters or mussels and in surficial sediments at all of its sites and the degree and effects of contamination on target fish species at a subset (approximately 30%) of its sites. The focus of the NOAA Status and Trends Program is to evaluate trends in contamination at specific sites. The focus of the EMAP near coastal program is to estimate the extent and magnitude of degradation of near coastal ecosystems from a range of pollution problems and to use changes in the extent and magnitude of degradation to evaluate the effectiveness of the Nation's pollution control programs and policies. In order to accomplish these objectives EMAP will measure a broad array of parameters. Pollution problems that will be covered by the EMAP near coastal program include low dissolved oxygen concentration, contamination, habitat modification (e.g., loss of vegetated habitat), emerging problems (e.g., global climate change, introduction of new chemicals), and cumulative impacts of all stresses.

Figure 1 (map following) identifies NOAA's National Status and Trends and EMAP near coastal sampling sites (all station categories) for the Virginian Province. Major differences between the types of sites sampled by the two programs include:

* The NOAA Status and Trends Program does not sample in low (< 10 ppt salinity) salinity areas of estuaries (e.g., upper portions of the Chesapeake and Delaware Bays -- Figure 1). In addition, the majority of the NOAA Status and Trends Program sites are in shallow or intertidal habitats (e.g., Long Island Sound -- Figure 1). The EMAP program samples estuarine habitats greater than 2 m in depth, including low salinity, brackish water, in proportion to their distribution and areal extent. EMAP does not currently sample shallow or intertidal habitats.

* The NOAA Status and Trends Program sample sites were selected to be representative of their surroundings based on scientific judgment. Small scale contamination and known points of waste discharge are avoided. The goal of the NOAA Status and Trends Program is to sample at locations judged to be representative of overall system condition. The EMAP near coastal program samples near coastal ecosystems, including polluted and unpolluted sites, in proportion to their distribution and areal

EMAP NC 1990 DEMONSTRATION PROJECT
SAMPLING STATIONS/NOAA STATUS AND TRENDS STATIONS



Projection Albers - Central Meridian -74 00 00

Produced by the EMAP GIS Team
July 1990

extent using a probability based sampling design that combines the strengths of random, systematic, and judgmental sampling.

EMAP sampling sites have only been defined for the Virginian province to date. Sampling schemes for other provinces will, however, resemble that for the Virginian province (Figure 1).

3. Describe the different biogeographic estuarine regions EMAP has identified. How many will be sampled?

The EMAP near coastal program has developed a regionalization scheme to group near coastal ecosystems into regions that have similar climates, biota, and environmental problems. This regionalization scheme is based on physical criteria because of the ease and precision with which physical boundaries can be defined. Twelve regions (called provinces) have been identified (Figure 2). Seven provinces are found in the continental United States. EMAP is only sampling in the Virginian Province at this time.

a. Will each of these regional biogeographic samples require four years to assess "normal" conditions?

Assessments of status can be made at any point in a four year cycle (e.g., after one year of sampling). Assessments based on less than a four year cycle have a higher degree of uncertainty associated with them than those made after a four year cycle. This is because interim assessments are based on fewer samples and are more influenced by variation resulting from natural events. Multi-year assessments provide more interpretable, meaningful, and robust evaluations of status and trends and reduce the impact of unusual years on establishing baselines.

b. How long will it take for all the estuarine biogeographic regions in the country to be sampled, so that we have good baseline data?

The EMAP Near Coastal program will be implemented in phases beginning with the estuaries of the Virginian Province in 1990. Baseline data will be available for estuaries in 1995.

c. Describe how this baseline data will be used as a basis to measure both natural and human induced change.

The key element to the assessment approach that the EMAP near coastal program will use to measure and partition natural and anthropogenic stress is the identification of a series of ecological indicators that are:

* Clearly valued by and of concern to society
* Quantifiable in a standardized manner with a high degree of repeatability
* Applicable across a range of habitats and biogeographical provinces
* Related to ecological condition in a way that can be quantified and interpreted.

Categories of indicators that will be sampled are:

* Response Indicators -- Measurements that quantify the integrated response of ecological resources to individual and multiple stressors. Examples include measures of the condition of individuals (e.g., frequency of tumors or other pathological disorders in fish), populations (e.g., abundance, biomass), and communities (e.g., species composition, diversity).
* Exposure Indicators -- Physical, chemical, and biological measurements that quantify pollutant exposure, habitat degradation, or other causes of degraded ecological condition. Examples include contaminant concentrations in the water, sediments, and biological tissues; the acute toxicity of sediments to sensitive biota; and dissolved oxygen concentration.
* Habitat Indicators -- Physical, chemical, and biological measurements that provide basic information about the natural environmental setting. Examples include water depth, salinity, sediment characteristics, and temperature. Habitat indicators will be used to normalize values for exposure and response indicators across environmental gradients (i.e., these parameters will help partition and qualify variations due to natural factors from that associated with man's activities).
* Stressor Indicators -- Economic, social, or engineering measures that can be used to identify the causes of environmental problems and poor ecological condition. Examples include human demographics, land use patterns, discharge records from manufacturing and sewage treatment facilities, freshwater inflows, and pesticide usage.

* Figure 3 provides an overview of the EMAP near coastal indicator strategy.

4. When will EMAP be able to report the status of our coastal ecosystems? How will EPA's report on the status and trends of coastal pollution differ from estimates of degradation of our coastal resources required under the National Status and Trends program?

The EMAP near coastal program will report on the status of the estuaries of the Virginian province in June 1991 and on the status of the estuaries of the Louisiana Province in June 1992. Both of these reports will be based on one summer's collections, and as such, will have a higher degree of uncertainty than if they were based on a complete four year sampling program.

Assessments made under the EMAP program will address all major pollution problems facing near coastal ecosystems and will focus on estimating the spatial extent and magnitude of ecosystem degradation. The NOAA Status and Trends Program reports mainly on trends in contaminant exposure for sediments, fish, and shellfish. EMAP near coastal and NOAA Status and Trends assessment efforts are therefore, complimentary. In the future, the EMAP near coastal and NOAA Status and Trends plan to produce a unified report on the status and trends of near coastal environmental quality(see the answer to question 7).

5. The 1990 demonstration project in the Virginian Province is supposed to estimate the extent of degraded estuarine resources. Can a demonstration program, particularly in one year, assess this?

The data that are collected during the 1990 Virginian Province Demonstration project can be used to assess the status of estuarine resources in the Virginian province. This assessment would, however, have a higher degree of uncertainty than would an assesment based on multiple years of data because of the smaller number of samples that will be collected and the bias that may be associated with any one year's collections. Multi-year baselines minimize the influence of natural year-to- year variation and decrease uncertainty because a substantially greater number of samples are collected. The goals of the 1990 Virginian Province Demonstration Project are much broader than just making a status assessment and include:

* Demonstrating the benefits of regional monitoring data collected in a standard way for a defined set of parameters using a robust sampling design as a basis for status assessments

* **Identifying, testing, and evaluating indicators of environmental quality for estuaries**

* **Standardizing sampling and processing methods for evaluating marine/estuarine environmental quality**

* **Evaluating alternative sampling designs and approaches for establishing a regional monitoring network in estuaries**

* **Developing analysis procedures for converting monitoring data into information useful to the public, Congress, environmental decision makers, and the scientific community**

* **Identifying and resolving logistical problems associated with conducting a regional scale monitoring program in estuaries.**

6. **Can EPA support, within existing budgets and with present staff, a monitoring effort of the type envisioned by the EMAP strategy? If this is not adequate, what additional funding and what additional staff will be required?**

The FY 1990 and 1991 EPA/ORD budgets and staffing are adequate to meet the current plans for all EMAP components. This is because a phased approach to implementation and program development is being used. The focus of the EMAP program during 1990 and 1991 are on program planning (e.g., development of a unified sampling design and indicator strategy) and field implementation of demonstration projects in near coastal and forests ecosystems.

a. What about for just the estuarine segment of the program?

The FY 1990 and 1991 EPA/ORD budgets contain adequate resources to implement the 1990 Virginian Province Demonstration Project as well as the 1991 Louisianian Province Demonstration Project and continued sampling in the Virginian province. Adequate staff are available to conduct these studies.

b. What would this budget look like? How many staff would be required?

The current EMAP strategy for estuarine monitoring is to conduct demonstration projects in the Virginian and Louisianian provinces aimed at showing the benefits of a regional monitoring network based on the EMAP sampling design and indicator strategy. The results of these demonstrations will allow us to refine the EMAP strategy.

c. How many years will it take to establish such a monitoring effort?

At this point in time, it is impossible to predict the rate at which the program may expand beyond the current scope.

7. Should there be more than one long-term federal research and monitoring program?

No, however due to the differing mandates of the various federal Agencies, a variety of federal research and monitoring programs with different objectives may be appropriate. Where the objectives of these research and monitoring efforts overlap and are compatible, they should be efficiently integrated to the extent possible.

8. If EMAP is to be a regional monitoring program, how will it move beyond site specific measures and extrapolate from data collected in particular locations to regional estuarine habitat status and trends?

EMAP is conducting measurements at individual sites as replicates for determining the condition of estuarine resources on a regional scale. A number of measurements have been selected as potential indicators of regional-scale status and trends in the condition of estuarine resources. These potential indicators are being tested and evaluated for their appropriateness this summer in the estuaries of the mid-Atlantic states. EMAP has not proposed measurements that are site-specific in nature.

9. What cumulative impacts are or will be assessed through EMAP? Will these assessments be for multiple impacts over a spatial or temporal region?

The EMAP near coastal program is not designed to assess the ecological impact of specific point-source discharges or the cumulative impact of all point source discharges. Rather, the program is designed to evalute the cumulative impact of man's activities on near coastal ecosystems and resources and to evaluate the effectiveness of environmental control policies and regulations for reducing or remediating those impacts. Analysis will be conducted to disclose the cumulative impacts into component impacts using the indicator strategy shown in Figure 3.

10. Will EMAP data sets be widely available outside the agency? What, if any, will be the cost to outside users (e.g., interest groups, university researchers, individuals) of accessing and obtaining data sets provided through the EMAP information system?

The EMAP near coastal program will use a distributed data management system. In this system, data are produced at a number of remote locations, where samples are processed. Results are then transferred to a central site where they are verified to be reasonable and are integrated into the Near Coastal Information Management System (NCIMS). The NCIMS will include data in both raw and summarized form to eliminate costly redundant analyses. Information on study characteristics, institutional and organization structures, sampling methods, sample status, data format, quality assurance, key personnel involved, and data access will be available for all data sets in the NCIMS. Data management reports that summarize the types, volume, and quality of data, as well as a list of the specific data sets available will be prepared and distributed to potential users frequently (e.g., every two years).

EMAP near coastal data will be made available to different types of users on different time scales, based on the quality assurance level of the data. The following groups of potential data users and their order of access have been defined:

* EMAP near coastal entities that generate data (e.g., field crews, sample processing laboratories)

* Near coastal primary users (the Field Coordinator, data management personnel, QA/QC Officer, Synthesis and Integration Team, Technical Director, and NOAA personnel working with the EMAP near coastal team

* EMAP data users -- All other EMAP task groups, EPA program and regional offices, and other federal agencies

* General public -- Academic personnel, and other state, and local governmental agencies.

Access for each of the user categories is defined in Figure 4.

Initially (1990-1991), the EPA VAX network will be the main means of access to data in the NCIMS. Users who do not have access to the VAX network will be provided direct dial access to the NCIMS, as appropriate. Access authorization will be established under the direction of the EMAP Associate Director for near coastal programs.

11. Based on EMAP's stated sampling design, an acceptable value from a deep channel sample would be used to characterize acceptable conditions in the estuarine system being measured. However, this is not the case if an unacceptable parameter is obtained (e.g., one identifying a high pollutant levels). Can you explain how, if acceptable values

can be extrapolated to the whole estuary, an unacceptable value is limited to inferences at only one specific site? If the deep channel samples are an index, doesn't it follow that regardless of whether a parameter provides positive or negative evidence for the existence of a pollutant, that it should be consistent in its ability to be used as an index to characterize the estuary?

There appears to be a misunderstanding concerning index site sampling. If we consider small systems, probability based sampling provides an unbiased estimate of the extent (area) of degraded conditions in the estuarine resource sampled. An index site sampling approach is different in that it provides an estimate of the number of small systems whose condition is degraded with respect to the specific problem area which the index sites have been chosen to represent. For example, a depositional area is the correct place to investigate sediment contamination. Since EMAP is sampling only one or two sites in these small systems, it can not adequately characterize each small system sampled. The program will however characterize the extent of a problem in the small systems of a particular geographic region (probability based sampling).

12. Would you please include for Congressional review and inclusion in the record the most current copy of the document, Environmental Monitoring and Assessment Program: Near Coastal Plan for 1990, (used by EPA's Office of Research and Development in Narragansett, Rhode Island to train staff in the methodology for sampling and monitoring the estuarine component for EMAP)?

The document, Environmental Monitoring and Assessment Program: Near Coastal Plan for 1990 is still in draft form. This draft is currently being revised to incorporate comments from a recent peer review organized by the Estuarine Research Federation (ERF). A copy of the final version will be forwarded to your office as soon as it is available.

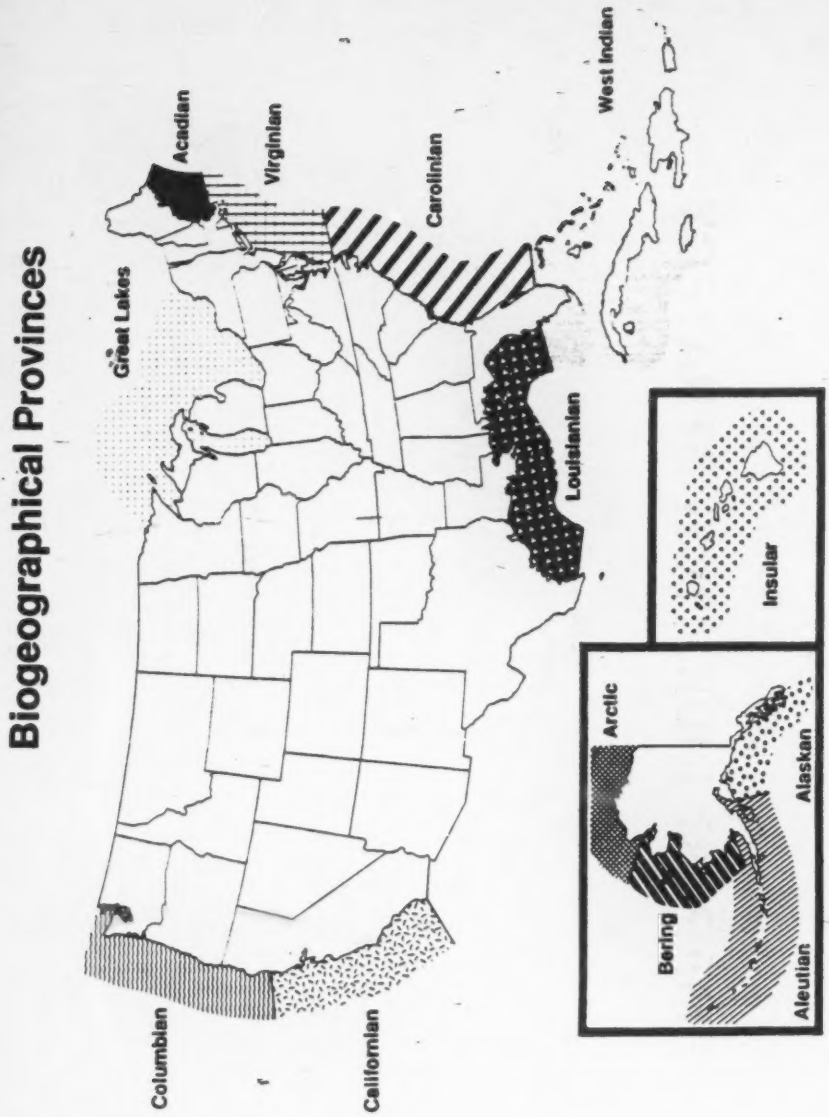


Figure 2. Biogeographical regions.

EMAP-NC INDICATOR STRATEGY

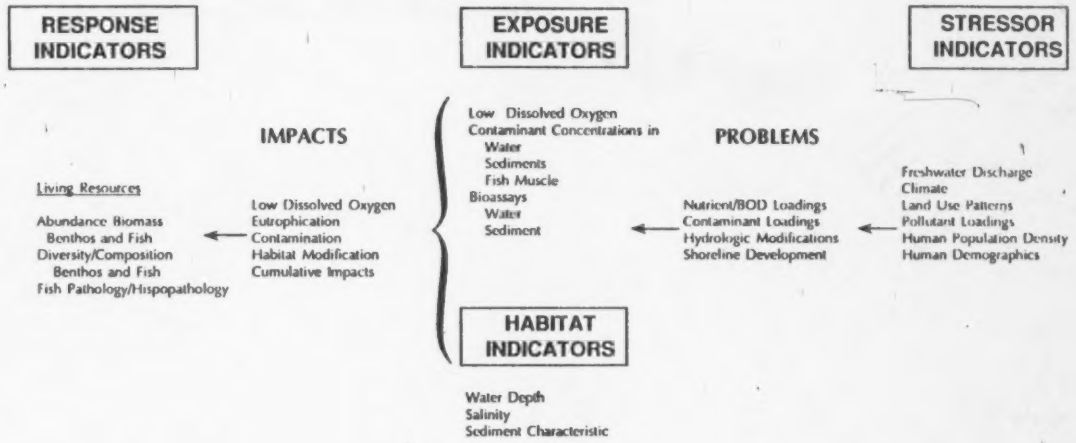


Figure 3. Overview of EMAP near coastal indicator strategy.

ES&A #22 3

Level of QA	Degree of Processing		
	Raw	Initial Summaries	Final Summaries
None	I*	I*	I*
Machine	I*, II*	I*, II*	I*, II*, III*
Complete	I*, II*, III*	I, II, III	I, II, III
Analysis Results	I, II, III, IV	I, II, III	I, II, III, IV

* These data users have explicitly agreed not to disseminate the data released to them and to use it only for specific purposes confirmed by the EMAP-NC Technical Director.

Figure 4. Matrix summarizing data access for various user groups as a function of the degree of data processing that has been completed and the level of quality assurance that has been completed. Group I = Organizations that generated the data; Group II = EMAP-NC primary users, including the Technical Director, NOAA, data management support staff and synthesis and integration staff; Group III = Other EMAP users and task groups; Group IV = General public.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

AUG 14 1990

Honorable James H. Scheuer, Chairman
Subcommittee on Natural Resources,
Agriculture Research and Environment
Committee on Science, Space, and Technology
U.S. House of Representatives
Washington, D. C. 20515

Dear Mr. Chairman:

Enclosed are NOAA responses to questions submitted as followup to the Subcommittee's June 26, 1990 coastal environmental monitoring hearing.

If you or your colleagues have any further questions, please contact me.

Sincerely,

Clifford Dowman
Acting Director

Enclosure

Questions for Charles Ehler
House Committee on Science, Space, and Technology
Subcommittee on Natural Resources,
Agriculture, Research, and Environment
June 26, 1990

Your testimony states that the expanded National Estuarine Research Reserve System (NERRS) program began in 1989 and that there are three phases in the monitoring program. In what year do you anticipate that Phase 3 will be reached by all of the currently existing Reserves?

The NERRS Phased Monitoring Program was established in 1989 to identify and describe resources critical to tracking the health of the reserve ecosystem. Under the new program, the reserves will formulate and implement resource monitoring programs that will provide a mechanism for determining whether the sites are addressing the long-term needs of estuarine resource management. The monitoring program will be an integral part of a comprehensive reserve research program.

At this time, the 18 existing National Estuarine Research Reserves are at different stages in developing their monitoring programs. While a few of the reserves have had the benefit of eight or more years of continual research and monitoring, others have very little basic information on the primary resources of their sites. The majority of the existing sites fall between these two extremes. Given the range of developmental stages present, we anticipate that it will take at least 10 years to bring all 18 currently designated NERRS to the final phase (Phase III) of developing and implementing a comprehensive monitoring program.

How much was NERRS budget (and other NOAA Program's) reduced to initiate NOAA's Coastal Ocean Program, which started this year? Describe how this loss of funds has and will affect achieving the original goals of NERRS. How has it affected the expanded monitoring program?

The NOAA Coastal Ocean Program began in FY 1988. It is being funded with separate Congressional appropriations. The appropriation for FY 1990 was $6.4 million. Neither the NERRS budget nor the budget of any other NOAA program has been reduced in order to fund the NOAA Coastal Ocean Program.

Can you tell me why NOAA's National Estuarine Research Reserve System should not be subsumed under EPA's National Estuarine Program (NEP)?

Since NERRS budget has reduced support within NOAA wouldn't it make sense to place this program where it could be bolstered and added to an existing estuarine program? Why or why not?

Wouldn't this extend EPA's monitoring efforts along the lines suggested in the NRC study (Managing Troubled Waters) by placing important basic estuarine research together with other monitoring programs, particularly compliance monitoring?

Since NERRS monitoring consists of extensive measurements at a limited number of sites, isn't this in keeping with EPA's National Estuarine Program, unlike NOAA's National Status and Trends monitoring, which is more of a limited monitoring program at an extensive number of sites?

The NERRS and the National Estuary Program (NEP), as mandated by Congress, have different objectives and purposes. The NEP was established by the 1987 Amendments to the Clean Water Act. Its major mission is to promote long-term planning and management in nationally significant estuaries threatened by pollution, development, or overuse. The main thrust of this program involves the integration of all aspects of water quality management and includes goals to protect and improve water and sediment quality and enhance living resources. To date, those estuaries designated as having "national significance" are those that have also been identified as among the most heavily impacted major coastal water bodies in the United States.

The mission of the NERRS is the establishment, acquisition and management, through a Federal-State partnership, of a national system of discrete estuarine areas as National Estuarine Research Reserves. These areas are representative of a national system of various regions and estuarine types in the United States. The reserves are established to provide natural field laboratories for long-term research, education, and interpretation. In order to provide long-term protection for the sites, land in the reserve is acquired using 50/50 Federal/state matching grants. A management plan is developed for each reserve that provides on-site staff and programs for education, research, management and enforcement.

The reserves provide researchers an opportunity to conduct research in an area whose boundaries and protected status provide site integrity. In other words, human influences on their research sites are minimized because of its protected designation. This is a very important factor in being able to differentiate between natural and human-induced environmental changes.

NOAA supports the NERRS and the Federal-state partnership remains strong. This partnership has led to a stronger commitment by NOAA and the states to work together to ensure continual operation and protection of these sites. Innovative management techniques, stronger state commitment, and cooperative education and research with a wide variety of Federal, state, local, and private agencies and institutions have improved the ability to manage the sites and achieve NERRS goals.

The monitoring programs of the NERRS and NEP are complementary, but different in scope and emphasis. Because of its origin in the Clean Water Act, the NEP focuses much of its attention on water quality and other parameters that affect human health. Their data are used to indicate compliance or non-compliance with certain health standards set by Federal and/or state agencies. On the other hand, the reserves are ecosystem oriented. The major goal of the NERRS is to assess the "health" of our Nation's estuaries by including a variety of estuarine types. All resources, including water quality, sediment and geological characteristics, living resources, and in some instances, air quality, are part of the overall reserve monitoring program. The reserve monitoring program is not necessarily oriented to meet regulatory standards. It is aimed at detecting whether or not the system is changing, whether these changes are good or bad, are human-induced or natural changes, and determining the appropriate management actions.

The NERRS is composed of representative estuarine areas found throughout the various biogeographical regions in the United States. This includes a broad spectrum of estuarine types and natural and cultural resources. Rather than being mandated to focus on the most heavily impacted major coastal water bodies, the NERRS has the flexibility to include estuaries of varying sizes and types. The extensiveness of monitoring efforts will vary from site to site, depending on the problems facing the region. The "representative" aspect of the program allows for the tailoring of monitoring efforts to meet the needs of estuaries that range from barely impacted to heavily impacted. This aspect, along with other statutory requirements, sets the NERRS apart from the NEP and the NOAA Status and Trends Program.

<u>The Administration has opposed the funding level authorized in Section 306 of H.R. 4030 (Jones), but what is the Administration's position on the funding level authorized under Section 315 of this same legislation (for the National Estuarine Research Reserve System)? Do they oppose or accept the proposed funding levels for NERRS and why?</u>

The Administration's Coastal Zone Management Act (CZMA) reauthorization bill, H.R. 4438, provides $3.5 million for Section 315 in FY 1991 and such sums as necessary in FY 1992-1995. The Administration opposes the higher funding authorization levels contained in H.R. 4030, which, for Section 315, are $7 million in FY 1991, raising to $8.4 million by FY 1995. These levels are inconsistent with the President's budget. Given tight budget constraints, the authorization levels in the Administration's CZMA bill provide adequate resources for CZMA programs.

How long does it take to establish a trend?

Within our coastal environment, what trends has NOAA documented during the six years that the National Status and Trends Program has been operating?

Are coastal conditions improving or deteriorating?

For a specific location, the answer depends on two related points: (1) how much year-to-year variation has to be accounted for before an overall trend can be identified; and (2) how much statistical confidence one requires for identification of that trend. The longer a historical record, the more likely a trend can be found. Identification of trends on a national scale also depends on the amount of data available but here, even if one has little confidence in the data for a single site, small differences can be meaningful if they occur at many sites.

The National Status and Trends Program (NS&T) database can be examined for trends over the period 1986 through 1989. These are the years for which there are annual data on contaminant concentrations in mussels and oysters. (There are NS&T data on sediments back to 1984 but data from analyses of surface sediments, while ideal for defining spatial distributions of contamination, are not amenable to deriving temporal trends.) The data from the mollusks, on the other hand, may be used to define trends because in the year between each collection the organisms adapt to changes in their environment. The 1989 data have just begun to be examined.

Through 1988, with only three years of contaminant concentration data from mussels and oysters, there are indications of decreasing trends in cadmium and chlordane concentrations in Long Island Sound and increases in copper, chromium, and mercury concentrations in the Hudson/Raritan Estuary. Other possible trends, usually decreasing, appear at other stations. All of these indications of trends will be tested for their continuation

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into 1989 and beyond as analyses are completed. Trends identified with four years of data can be accepted more confidently than those from three years.

Based on current NS&T results, and data from earlier studies, we can say that overall levels of contamination in the coastal and estuarine environments of the United States are decreasing. We say that because we have compared NS&T data collected in recent years with that obtained by other investigators 10 to 20 years ago. In mussels and in oysters, chlorinated organic compounds, such as DDT and PCB, are now lower everywhere.

Most trace element concentrations are unchanged statistically over the ten years since the last national monitoring program, but there are exceptions. The element lead has decreased in concentration everywhere, cadmium has generally decreased, and copper concentrations are increasing. In some places, where conditions allow, decadal trends in contamination can be derived from analyses of sediment layers. Wherever that has been done, there does appear to be an overall decrease in concentrations of both organic and inorganic contaminants since the 1970s. NOAA is investigating contaminant concentrations in sediment layers from additional cores to verify these trends.

Part of NOAA's monitoring efforts include the work of the National Ocean Pollution Program Office (NOPPO), pursuant to the mandates in the National Ocean Pollution Planning Act (NOPPA). What effect would moving the coordinating functions of NOPPO to CEQ have?

Would NOAA support CEQ's leadership of coastal and ocean pollution planning efforts?

How would maintaining the research efforts, conducted under NOPPA, at the Office of Oceanography and Marine Assessment affect NOPPA's program execution?

The responsibility for interagency coordination of Federal marine pollution research, development, and monitoring activities has resided in NOAA since the passage of NOPPA in 1978. During this time, NOAA has fully supported this responsibility through the efforts of NOPPO and through the NOAA line offices. As a result of this support, and the cooperation and involvement of other Federal agencies that participate in the national Marine Pollution Program, the National Ocean Pollution Policy Board (Board) has become an effective mechanism for interagency marine pollution information exchange, identifying research and information gaps and recommending actions to address these gaps. Transferring marine pollution coordination responsibility to CEQ would probably accomplish very little in the way of more

effective interagency coordination.

The Office of Oceanography and Marine Assessment (OMA) received approximately $2.9 million under NOPPA to implement its research and monitoring programs in FY 90; an additional $10.7 million was appropriated under Title II of the Marine Protection, Research, and Sanctuaries Act. In comparison, NOPPO received about $1.1 million in FY 90 to implement its program. Most of the existing research and monitoring activities carried out under Section 6 of NOPPA is already managed by the Office of Oceanography and Marine Assessment. Maintaining these activities within OMA would have few, if any, effects on program execution.